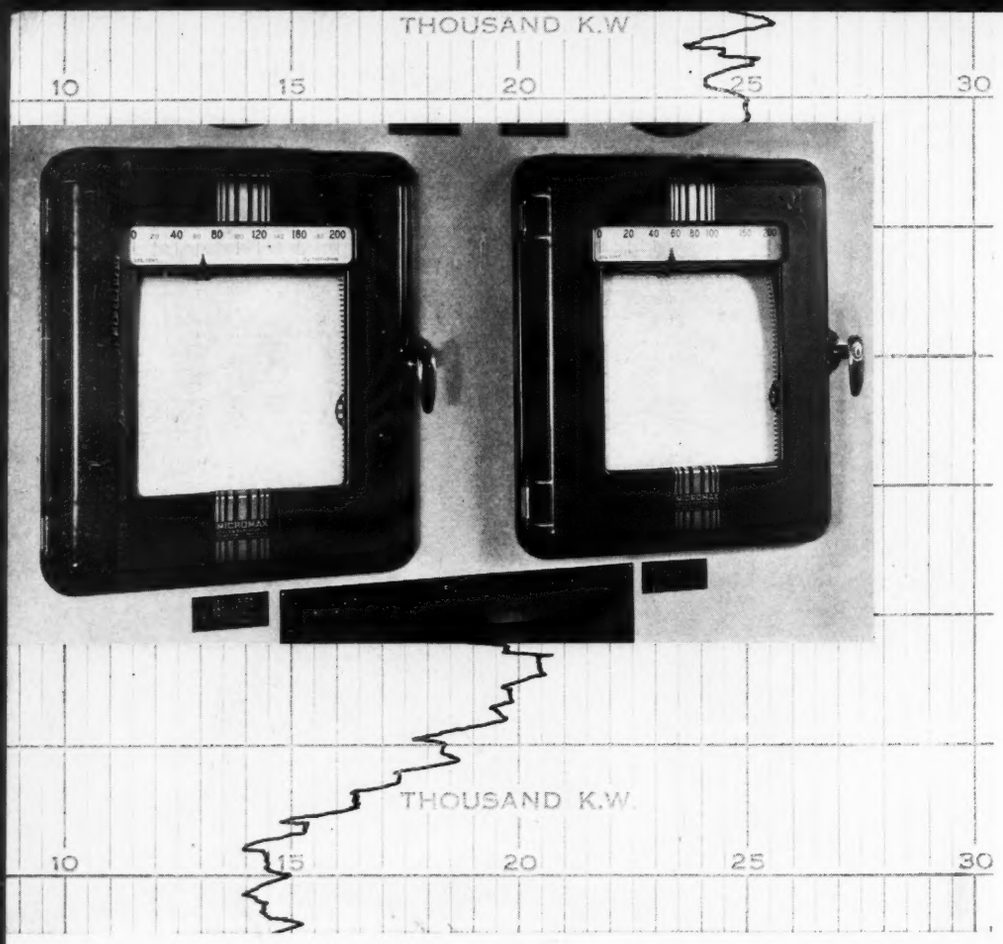
POWER

JULY, 1942

"United We Stand"



When load begins to rise, as shown by this Micromax load record, the temperature recorders shown in the insert help watch over generator temperatures. Multiple-point Micromax at left records stator temperatures; instrument at right records rotor temperature.

MICROMAX TEMPERATURE RECORDERS Will Help When Overload Piles Up

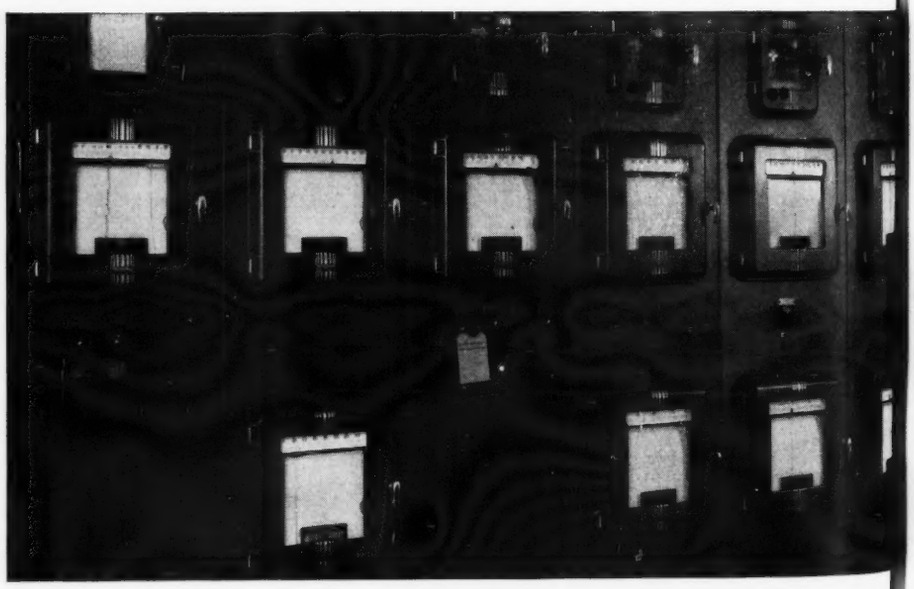
Several years ago, an east-coast power plant was confronted with the need for running at as much overload as it could carry, for a period of several days. Instead of loading their generators solely on the basis of wattmeter and ammeter readings, they used generator temperature, as shown by a Micromax recorder, as the limiting factor. By running right at the highest safe temperature, they got through the emergency safely.

Today, such emergencies are more frequent, for increased requirements of war industries are causing severe peak loads all over the country. And it is even more essential now to hold temperatures below dangerous values, in order not to endanger equipment that is both badly needed and difficult to replace. At the same time, it is often necessary to have machines carry the absolute maximum load without exceeding the permissible temperature.

In many power plants, Micromax temperature recorders are helping to protect equipment by giving operators the required temperature facts accurately and dependably. On the Micromax chart, the operator can watch the rate of heating or cooling, and by holding this rate at a low value, he can allow copper and insulation to expand or contract at the proper rate without excessive strain on the insulation.

Micromax instruments are frequently equipped with alarms or signal lights which summon the operator when the safe limit of temperature is exceeded. Rotor temperature recorders are single-point instruments. For recording other temperatures, however, multiple-point Micromax instruments can be used for as many as 16 temperatures.

If you'd like further details, we'll be glad to send, on request, Catalog N-33-161, *Micromax Temperature Instruments for Electric Power Equipment.*



On this control panel for a large hydro station are Micromax temperature recorders for fields and stators of three generators. Shown also are Micromax transformer temperature recorders, and instruments for load-frequency control.

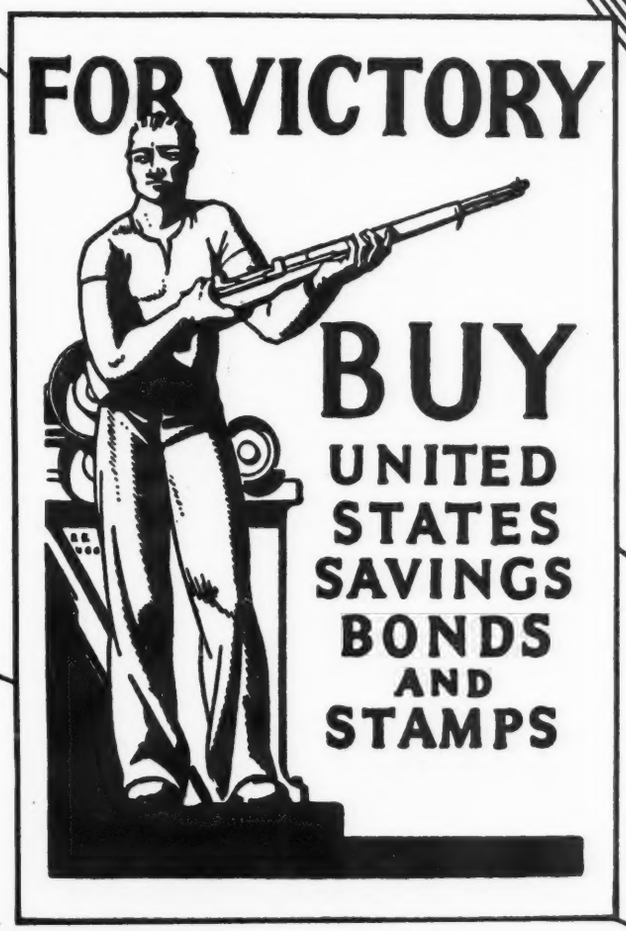
Jrl. Ad N-33-161(2)

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), July, 1942, Vol. 86, No. 7. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany, N. Y. Editorial and Executive offices, 330 West 42nd Street, New York, N. Y. Entered as second class matter August 25, 1936, at Post Office, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42nd Street, New York, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 one year, $4.00 for two years, $5.00 for three years. Canada, $3.50 for one year, $5.00 for two years, $6.00 for three years. Great Britain and British Possessions 36 shillings per year. All other countries $6.00 for one year, $9.00 for two years, $12.00 for three years. 35c per copy.



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VICTORY will be ours only as we the people back up our Government and our fighting forces throughout the world.

We—individually—can do our part by making further sacrifices—and one way that is most effective is to buy United States war bonds and stamps.

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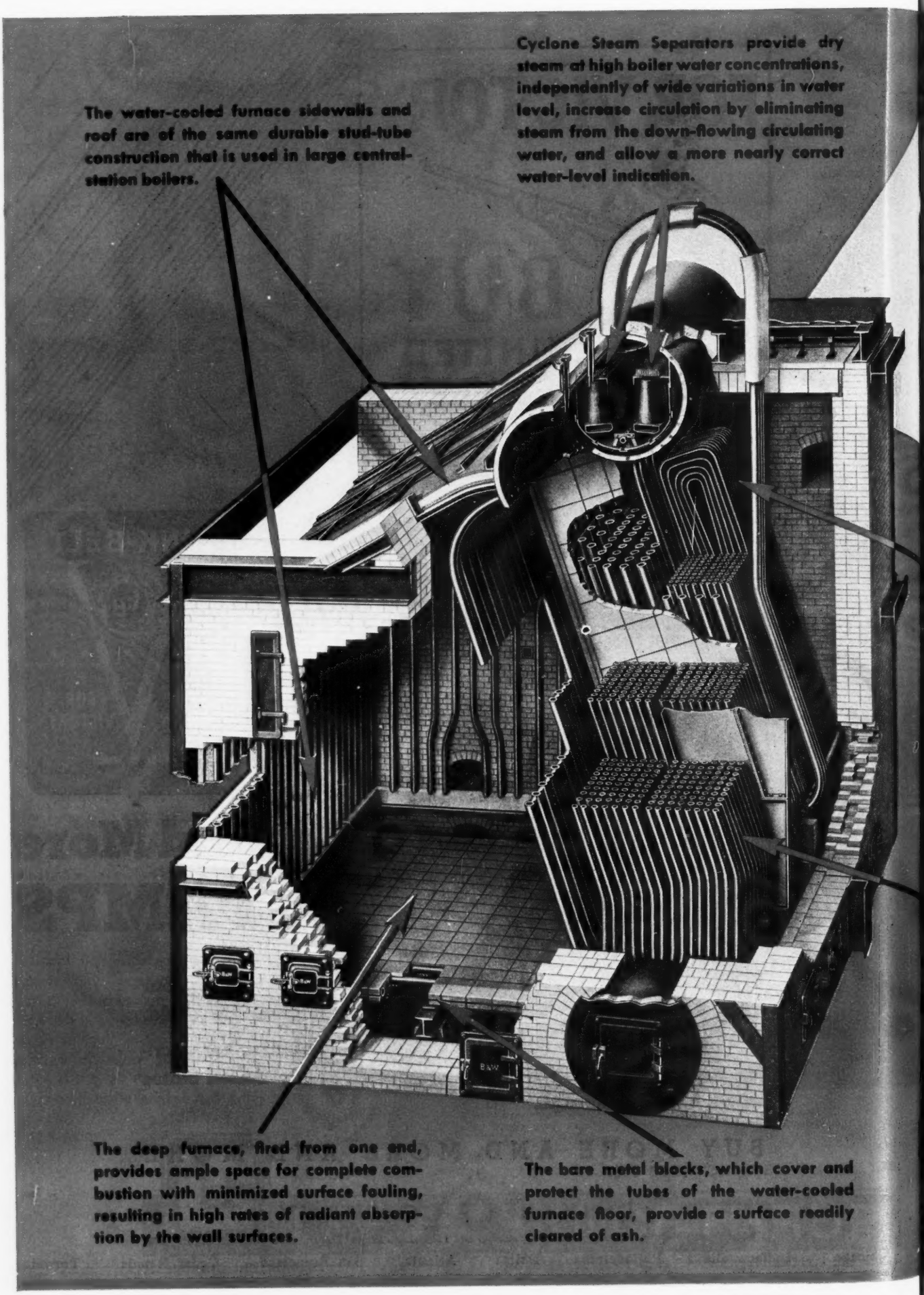
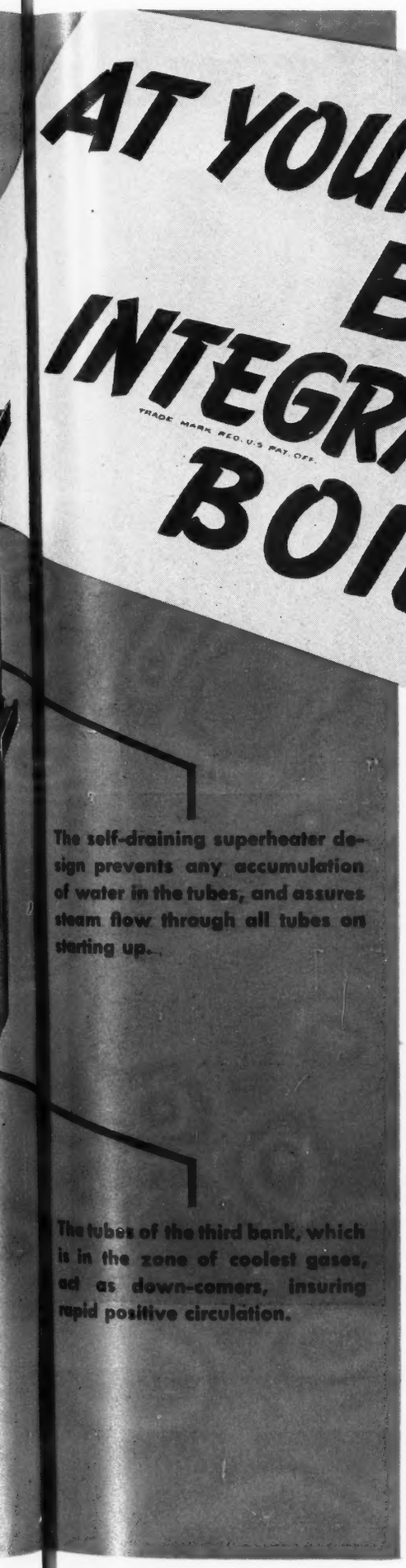

The water-cooled furnace sidewalls and roof are of the same durable stud-tube construction that is used in large central-station boilers.
Cyclone Steam Separators provide dry steam at high boiler water concentrations, independently of wide variations in water level, increase circulation by eliminating steam from the down-flowing circulating water, and allow a more nearly correct water-level indication.
The deep furnace, fired from one end, provides ample space for complete combustion with minimized surface fouling, resulting in high rates of radiant absorption by the wall surfaces.
The bare metal blocks, which cover and protect the tubes of the water-cooled furnace floor, provide a surface readily cleared of ash.

AT YOUR SERVICE TOO—
B & W INTEGRAL FURNACE BOILERS

TRADE MARK REG. U.S. PAT. OFF.


The self-draining superheater design prevents any accumulation of water in the tubes, and assures steam flow through all tubes on starting up.
The tubes of the third bank, which is in the zone of coolest gases, act as down-comers, insuring rapid positive circulation.

One hundred and one B&W Integral-Furnace Boilers have been purchased for central-station service by fifty-six utilities. Of these purchasers, eighteen, or 34 per cent, have ordered additional units on the strength of the performance of the original installations.

These repeat orders based on experience constitute approximately 36 per cent of the total number of these boilers purchased for central-station use.

This outstanding record of the Integral-Furnace Boiler for availability under all conditions of load, steam characteristics, and most methods of firing indicates its ability to serve satisfactorily under all the usual conditions of central-station service.

G-2291

The Navy "E" Award to the Barberton Works for production achievement is "an honor not lightly bestowed and one to be cherished."

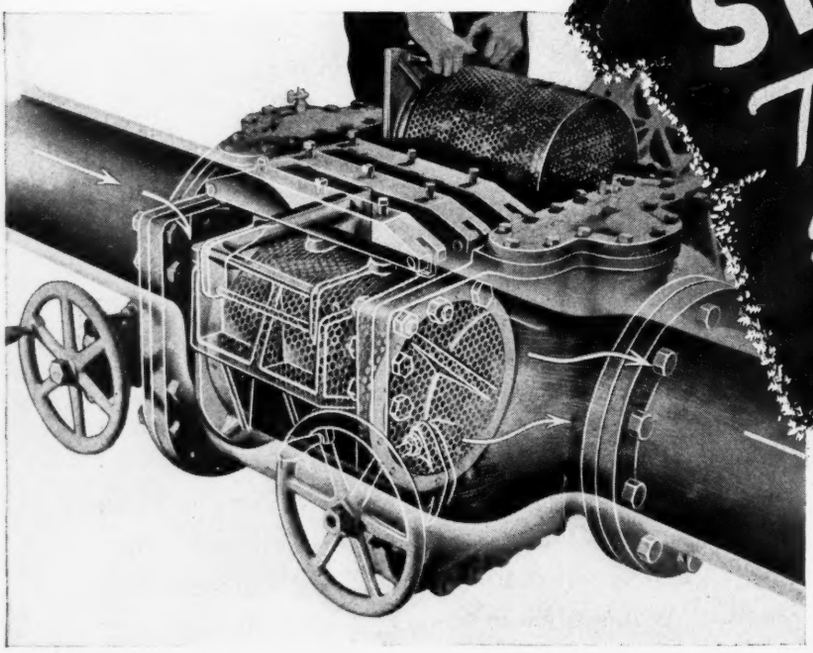
BABCOCK & WILCOX

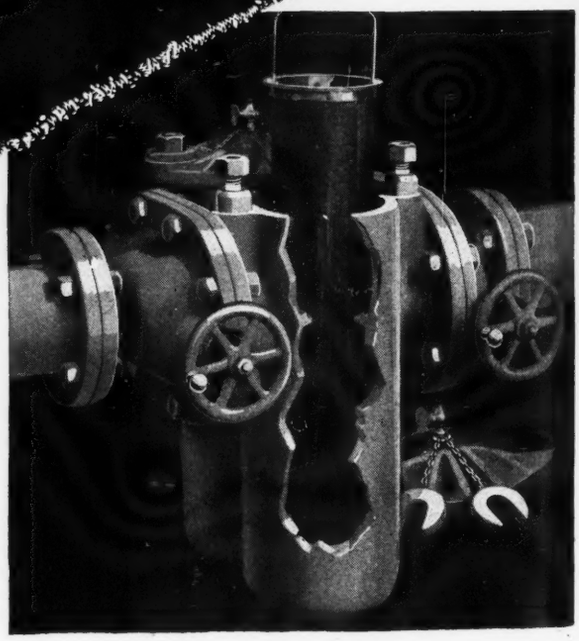
THE BABCOCK & WILCOX COMPANY
85 LIBERTY STREET NEW YORK, N. Y.

They trap trouble

ELLIOTT STRAINERS

The power plant's service of security





TWIN STRAINERS — standard equipment for clearing water and other liquids. One side always in operation while the other is shut off for cleaning. Sizes 2 in. to 42 in. Working pressures up to 150 lb. Single strainers, too, where occasional shut-down is allowable.

TWIN OIL STRAINERS (at right) built on same principle as above, especially for use with fuel and lubricating oil, and process liquids. Sizes 1 in. to 12 in., pressures to 300 lb.

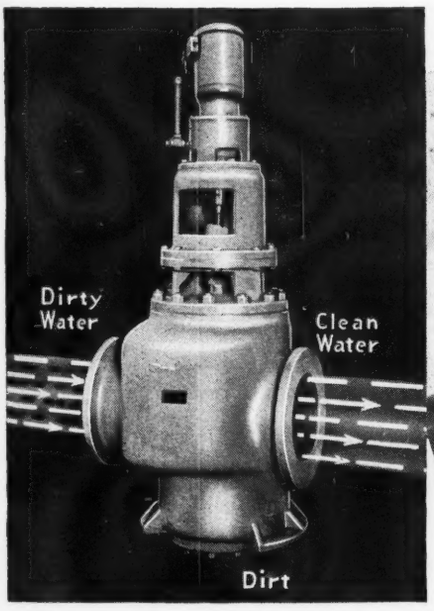
ELLIOTT

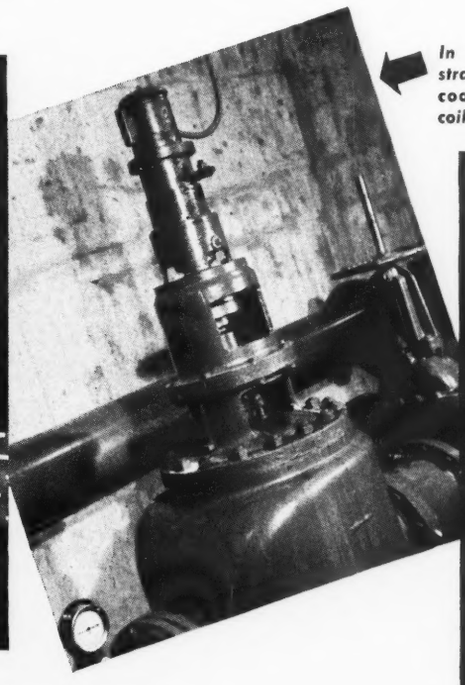
to hasten VICTORY

They avert calamities, these Elliott strainers. With unsleeping vigilance they render harmless the bits of debris, trash and foreign matter in water or oil that would otherwise score valve seats, jam or break pistons, clog lubricating lines, cause burners to fail, and all in all create enough delay, breakage and trouble to make glad the heart of any fifth columnist.

Thousands of Elliott strainers in various types are serving the nation on shipboard, keeping oil and water lines clear . . . in power plants large and small . . . in the process industries, straining liquids and solutions of various kinds, such as paint, molasses, tar. Their uses are manifold — their combined protective value enormous. It is safe to say that should all the Elliott strainers now in service suddenly cease operation, the result would be as bad as a fair-sized naval defeat.

If you have a straining question to answer, use the expert help of Elliott engineers.





In a hydro plant — one of five straining water for transformer cooling and generator cooling coils, and fire apparatus.

In a central station—one of three self-cleaning strainers which provide clear water for bearing cooling.

CONTINUOUS STRAINERS

clean themselves, need no attention. Used on water lines, continuous backflow automatically flushing out foreign matter. Especially valuable where large quantities of fine dirt, etc., must be removed. Sizes, 4 in. to 24 in., pressure to 125 lb.

A-272

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How to Increase *power output* WITHOUT ADDING *equipment*

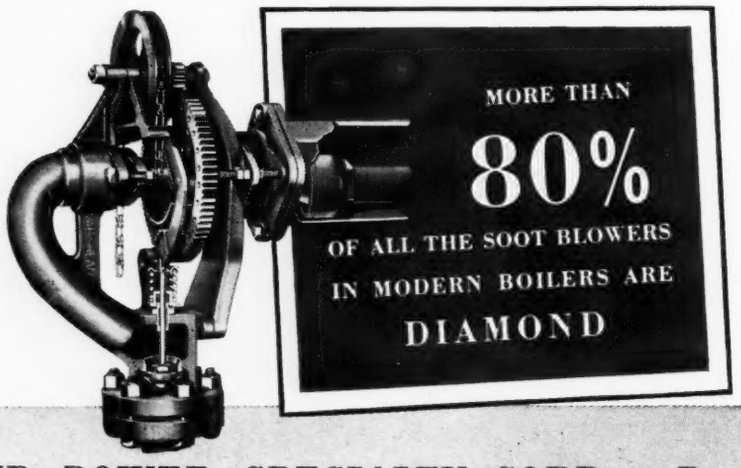
GET THE MOST OUT OF YOUR SOOT BLOWERS

With power demands increasing rapidly and additional equipment difficult to get, all the boilers you have in service are likely to be taxed to their utmost capacity. Using your soot blowers so they do the best possible cleaning job is one way you can increase power output without adding equipment.

More careful attention to the blowers you have—adoption of a regular schedule of periodic inspection, lubrication and adjustment, will enable them to do a better job of cleaning. At the same time, they will last far longer and defer the expense of new blowers.

Diamond Soot Blowers are built to take severe service and stand up for long periods under the regular daily blowing schedule.

But the best mechanisms are better for a little extra care, and Diamond Blowers will repay such care in better and longer service.



DIAMOND POWER SPECIALTY CORP. • Detroit, Michigan
DIAMOND SPECIALTY LIMITED • Windsor, Ontario

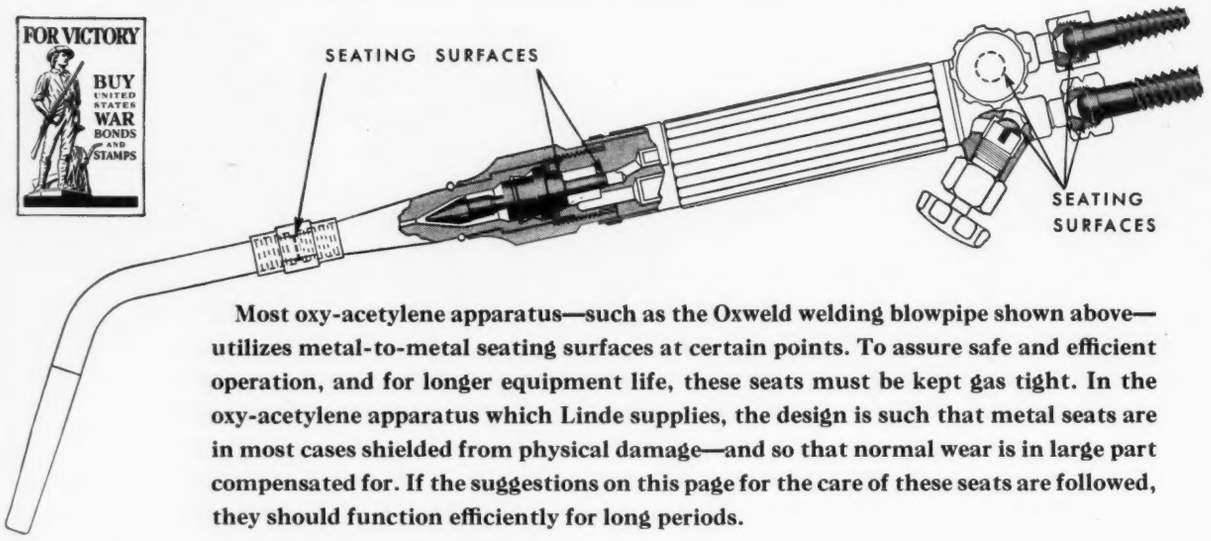
THE DIAMOND SERVICE ORGANIZATION

This is maintained to help you get better service from your Diamond Soot Blowers.

The next time the Diamond Service Engineer calls at your plant, ask him to help you set up your own program of care. He will be glad to help, and you will find it worthwhile.

For Efficient Operation and Longer Life

Take Care of Metal-to-Metal Seats



Most oxy-acetylene apparatus—such as the Oxweld welding blowpipe shown above—utilizes metal-to-metal seating surfaces at certain points. To assure safe and efficient operation, and for longer equipment life, these seats must be kept gas tight. In the oxy-acetylene apparatus which Linde supplies, the design is such that metal seats are in most cases shielded from physical damage—and so that normal wear is in large part compensated for. If the suggestions on this page for the care of these seats are followed, they should function efficiently for long periods.

What Happens When Seats Leak

Flame Characteristics may be seriously affected when a blowpipe seat leaks because of mars, dents, or scratches—or because it has not been correctly tightened. This makes good work difficult to perform.

Inefficient Operation results from leaky seats and may cause flashbacks which will deposit carbon on seating surfaces throughout the blowpipe. Such deposits, if not removed immediately, will become ground in and heavily encrusted. This condition will cause increased leakage which in turn will bring about still further inefficiency.

Increased Costs result from working with damaged equipment. Never use oxy-acetylene equipment which is in need of repair. When parts with metal seats which are in good condition are assembled to dirty or damaged seats, the result is apt to be that the good seats are also ruined. Take precautions against small leaks which may present a fire hazard.

How to Prevent Damage to Seats

Keep Them Clean—when dirt or grit is present on metal seating surfaces, scratches and mars may result from tightening up the connection, and a leaky seat will result. For this reason, frequently wipe all metal seats clean.

If a Flashback Occurs, it usually is because of improper handling or incorrect pressures. However, it may be due to a leaky seat. Before relighting the blowpipe, examine *all* seating surfaces and wipe away with a clean cloth any carbon deposits left by the flashback. Then make sure all seating connections are tight. If the blowpipe still flashes back, the cause should be determined and corrected before using the apparatus further.

Always use a Wrench in making connections where a nut is provided for this purpose. Never tighten a welding head onto a blowpipe by twisting the stem. This will usually fail to make a gas tight connection, and will invariably cause excessive wear or damage to the seats.

Blow Out Cylinder Valves before connecting a regulator by opening them for an instant to blow out dirt and grit. If you do not, any dirt or grit present will damage your regulator inlet nipple seat, because cylinder valve seats are the harder of the two. Always read instruction books.

Instruction Books Available

• Duplicate copies of the instruction books packed with oxy-acetylene apparatus supplied by Linde, will be sent without charge upon request. Be sure to specify the type of apparatus you have.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

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You Can Obtain Copies of this Advertisement For Distribution in Your Shop . . . or to Post on Your Bulletin Boards . . . Upon Request.

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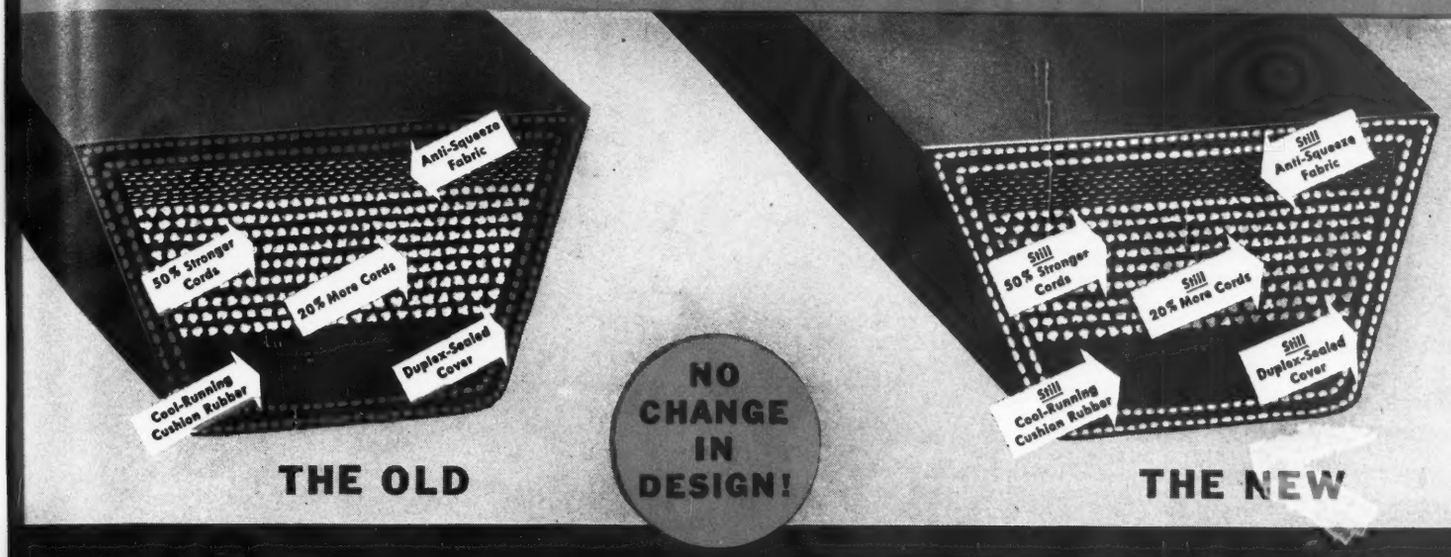
The words "Linde," "Prest-O-Lite," "Union," "Oxweld," "Purox," and "Prest-O-Weld" are trade-marks of Units of Union Carbide and Carbon Corporation.

More RED for the RED WHITE & BLUE



TEXROPE Goes to a war-time black!

YOU STILL GET . . .

1. The 50% stronger cords made possible by the sensational new Flexon process.
2. The 20% more cords that help give Texrope Super-7 V-Belts their extra "muscle".
3. The increased life provided by Texrope's shock-absorbing, cool-running rubber cushion.
4. The extra protection against grit, grease and dampness of the duplex-sealed cover. The *only* thing changed in cover design is the color!

NO ONE SAID we *had* to do it . . . but by sacrificing the red surface color identified with Texrope* Super-7 V-Belts, more rubber could be made available for Uncle Sam's new and special war-time needs.

So Allis-Chalmers did what *you* would have done . . . switched the famous "Red Belt" to a war-time black.

Will this color change affect you adversely? No. In each and every detail of quality-design, *Texrope V-Belts are unchanged!* They're still the same tough, smooth-working belts . . . that were literally *made to order* for today's new three-shift-a-day, round-the-clock operating schedules.

To step up the war-time efficiency of *your* power transmission, get the advice—and help—of your Texrope dealer or the Allis-Chalmers district office near you. Or write Allis-Chalmers, Milwaukee, Wisconsin. A-1517

*Trade mark registered U. S. Patent Office. Texrope Super-7 Belts are the result of the co-operative research and design genius of *two* great companies — Allis-Chalmers and B. F. Goodrich — and are sold exclusively by Allis-Chalmers.

Available in all sizes 1/2 hp to 2,000 hp

ALLIS-CHALMERS
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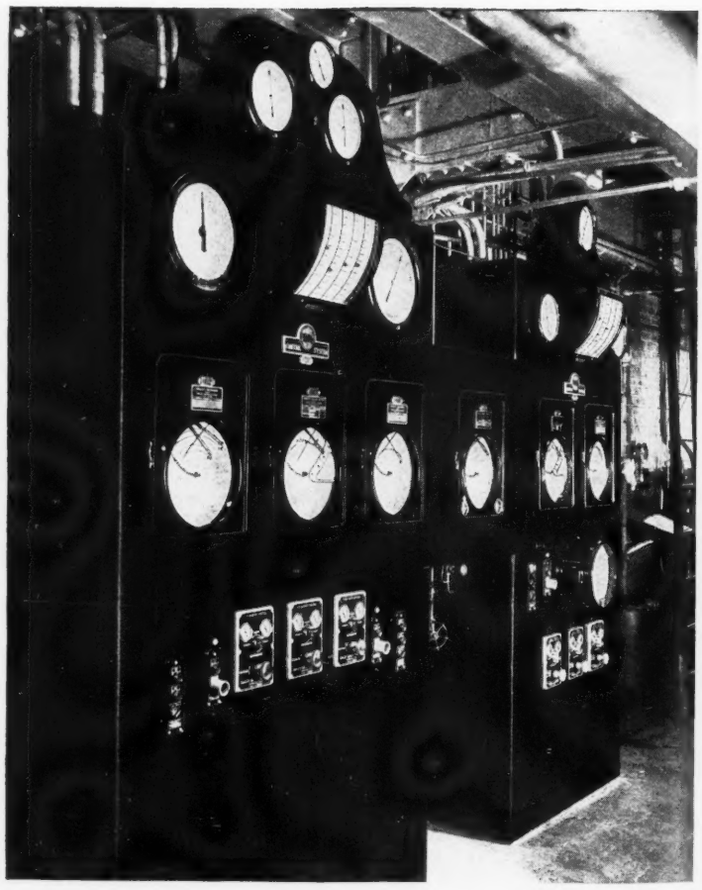
WE WORK FOR VICTORY — WE PLAN FOR PEACE

GAINS OF
SLIP

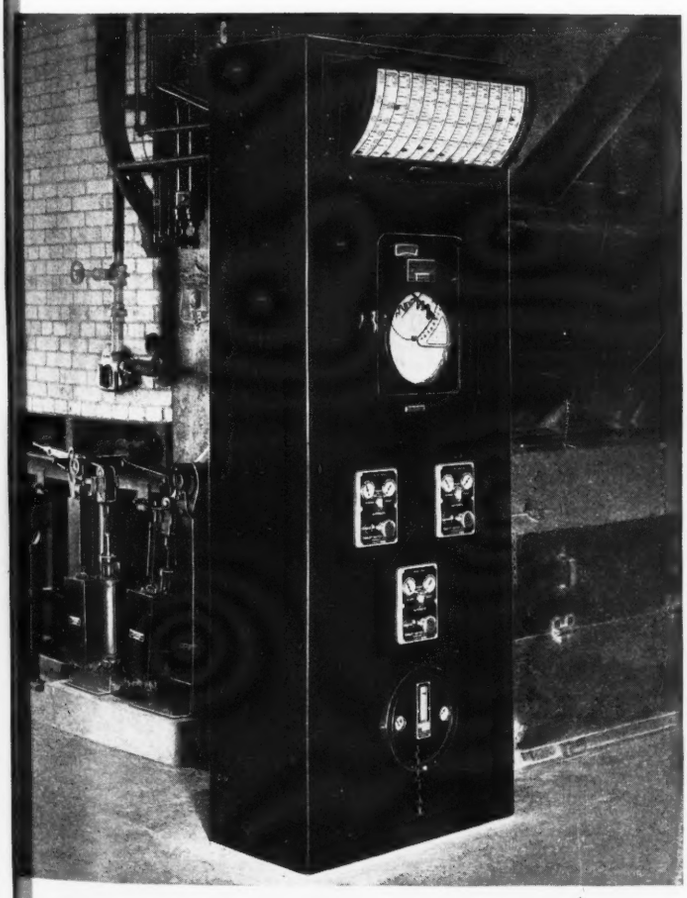
Bailey Boiler Control Panels serving oil fired boilers at the Scott Paper Company, Chester, Pa., and combination fuel (coke oven gas and coke breeze) fired boiler at Carnegie-Illinois Steel Corporation, Irvin Works.



BAILEY METER CONTROL . . .

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEAT

MODERNIZATION MAY THROUGH YOUR FINGERS UNLESS—*You Insure Full Steaming Capacity and Continuous Combustion Economy with* BAILEY METER CONTROL



★ Modernization is helping many boiler plants to safely and efficiently stretch steaming capacities to today's tempo. Regardless of whether your modernization program includes revamping of existing equipment or the purchase of new boilers, you should take care that the gains resulting from it do not slip through your fingers. To actually capture the benefits made possible by new or modernized steam generating equipment, optimum combustion conditions must be continuously maintained. This can be done by the use of Bailey Meter Control.

Bailey Meter Control is a complete system which has many outstanding features in addition to the usual advantages of boiler control:—

1. It is a coordinated system including; Metering equipment ... Complete Combustion Control ... Three-element Feed Water Control ... Feed Water Pump Control ... Superheated Steam Temperature Control.
2. It provides automatic readjustment of fuel—air ratio to insure continuous fuel economy.
3. Numerous safety features in the form of interlocks and warning devices may be included as part of the system.
4. The Bailey organization provides dependable service on meters and control directly from some 30 conveniently located cities in the United States and Canada.

When you select a combustion control system for your modernized boiler plant, be sure that you get one which is complete and fully automatic. Bailey Meter Control will run for weeks without the necessity of manual readjustment.

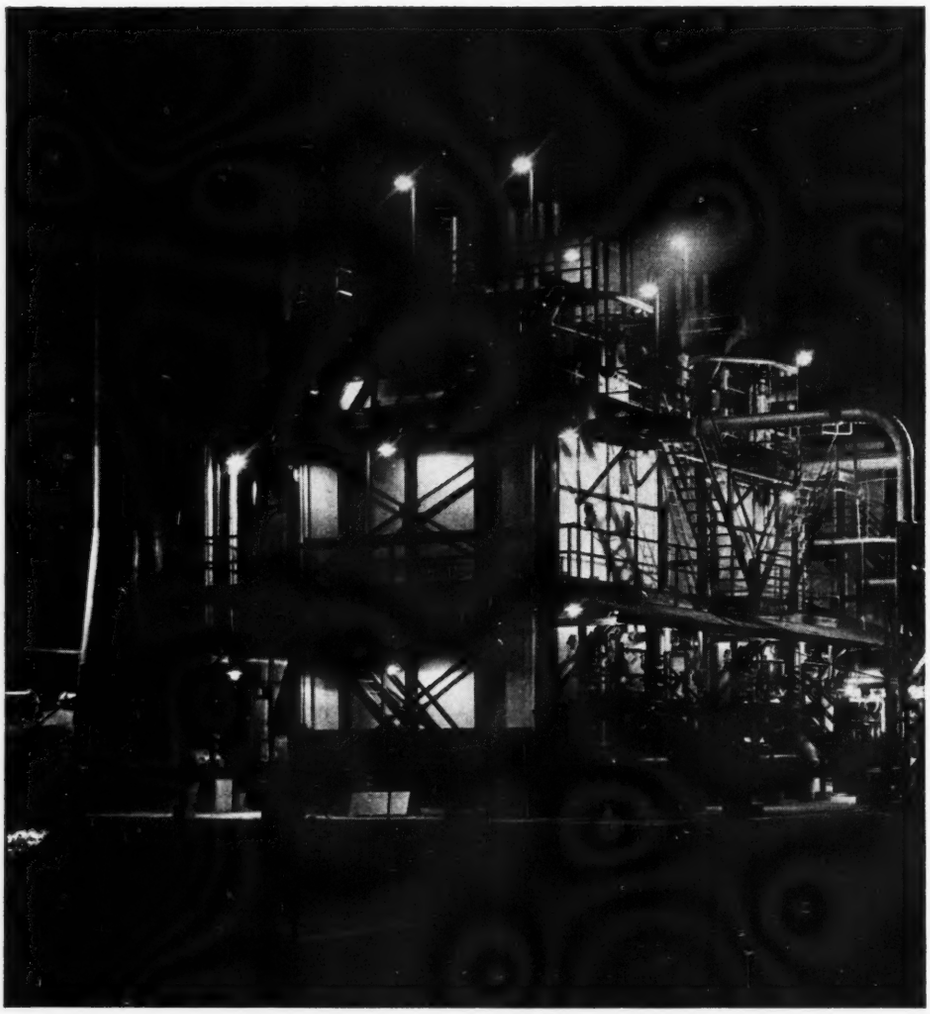
A-75

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada

The Complete Combustion Control System

CONTROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

THREE "S-A" BOILERS



Operating night and day to fuel the Allied Nations, two of the three boilers receive no protection from weather except a small corrugated roofing over the control board and burners.

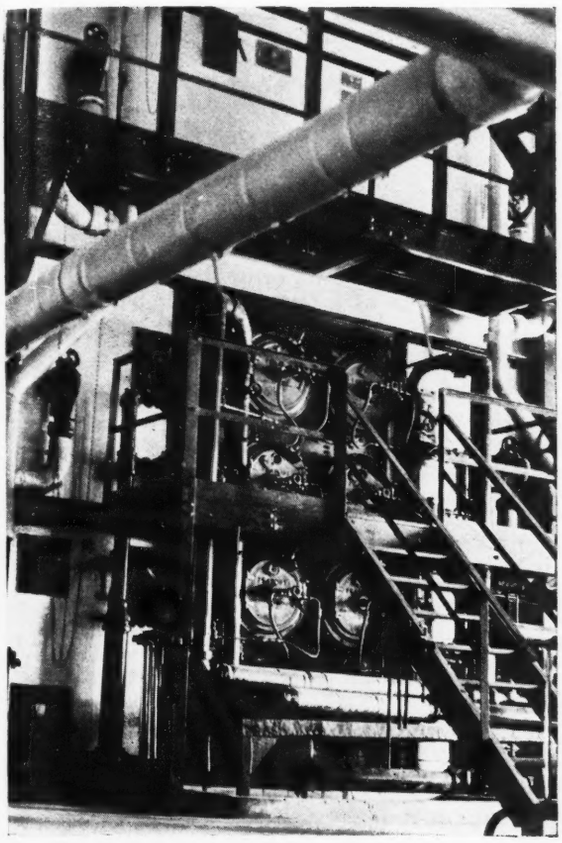
These units, each of 75,000 pounds steam per hour at 195 pound pressure and 50 degrees superheat, show an efficiency of 77.3 per cent without heat recovery equipment when burning refinery gas fuel.

Low installation cost was obtained by constructing for outdoor service as mild climatic conditions prevail at this world renowned refinery. Two of the steam generators—as illustrated—are provided with weather proof steel casings, designed with ample provision for expansion and contraction, thoroughly insulated, and effectively flashed to prevent casing leakage.

FOSTER WHEELER CORPORATION

FW FOSTER

FOR OIL REFINERY



TROUBLE FREE OPERATION

CHIEF FACTOR

IN SELECTION OF

"S-A" DESIGN

Firing front of the third steam generator which is equipped with a small extended surface economizer. Burners use either gas or oil fuel giving efficiency of 79 per cent with refinery gas. Capacity 60,000 lb. steam per hr. at 300 lb. pressure with F.S.T. 688° F.

Located hundreds of miles from sources of supplies and replacements, the importance of easy repair, simplicity and dependability was of paramount importance to the refiner. The selection of three Foster Wheeler "S-A" units is a definite recognition of preeminence in these qualifications.

In addition to these important operating advantages, the engineering design and construction embody progressive characteristics including:

- **1. LONG GAS TRAVEL FOR COMPLETE COMBUSTION.**
- **2. SUFFICIENT COOLING OF GASES IN FURNACE TO PREVENT SLAGGING.**
- **3. MINIMUM AMOUNT OF REFRACTORY SETTING.**
- **4 HIGH EFFICIENCY.**
- **5. COMPACTNESS OF DESIGN AND LOW HEADROOM.**
- **6. EXCEPTIONALLY LOW DRAFT LOSS.**

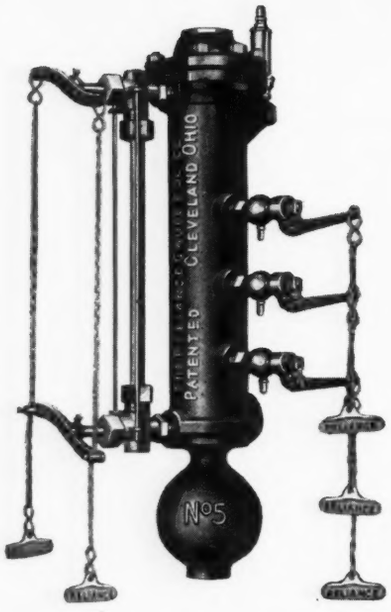
165 BROADWAY, NEW YORK, N. Y.

WHEELER

You can help Win the War

Right in Your Power

How to check your Boiler Water Column assure safe, accurate



1 UNBALANCED PRESSURE producing a false water level may be caused by (*a*) water pockets in steam piping; (*b*) connections from two different drums; (*c*) connections from opposite sides of drum head.

2 Be sure steam and water connections are not made between a baffle and the discharge end of generating or circulating tubes.

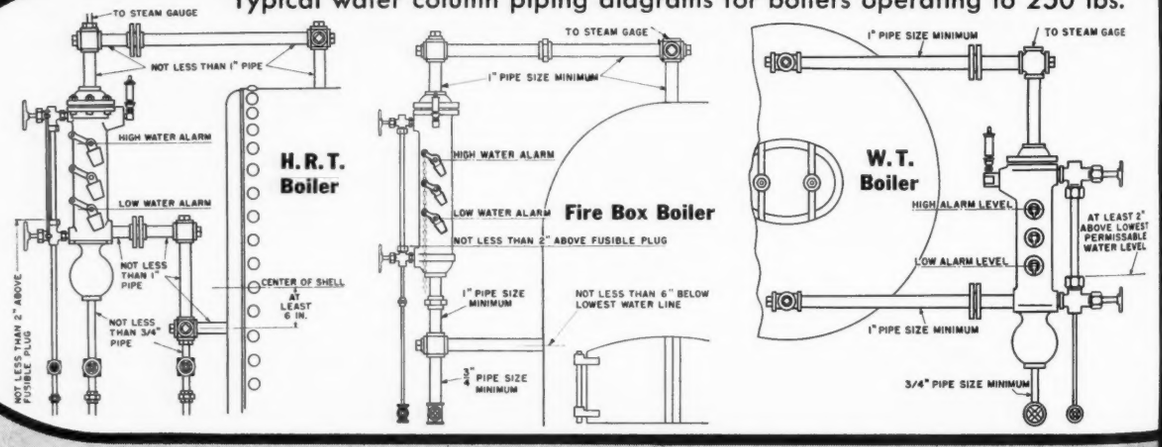
3 Check the steam connection particularly. Does it hook up with a dry pipe or above a steam baffle? *It shouldn't!*

4 Be sure that openings in the drum, to steam and water connections, are protected against direct impingement from circulating or generating tubes.

5 Is the column supported so that connecting pipes are free to expand longitudinally—where the column is not connected to the drum head?

6 Is the column supported by the same structure that supports the drum? This will prevent relative settling. If the drum is supported by the

Typical water column piping diagrams for boilers operating to 250 lbs.


TO STEAM GAUGE
NOT LESS THAN 1" PIPE
HIGH WATER ALARM
LOW WATER ALARM
NOT LESS THAN 1" PIPE
NOT LESS THAN 3/4" PIPE
NOT LESS THAN 2" ABOVE FUSIBLE PLUG
CENTER OF SHELL AT LEAST 6 IN.
H.R.T. Boiler
TO STEAM GAGE
1" PIPE SIZE MINIMUM
HIGH WATER ALARM
LOW WATER ALARM
NOT LESS THAN 2" ABOVE FUSIBLE PLUG
Fire Box Boiler
1" PIPE SIZE MINIMUM
NOT LESS THAN 6" BELOW LOWEST WATER LINE
3/4" PIPE SIZE MINIMUM
1" PIPE SIZE MINIMUM
TO STEAM GAGE
W.T. Boiler
HIGH ALARM LEVEL
LOW ALARM LEVEL
AT LEAST 2" ABOVE LOWEST PERMISSABLE WATER LEVEL
1" PIPE SIZE MINIMUM
3/4" PIPE SIZE MINIMUM

Since 1884

Reliance

Plant

Be alert to prevent even minor power failure . . . check your water column equipment

Connections to water gage reading . . .

boiler tubes, better see that the column is attached direct to the drum head or support it so it will move with the drum.

7 Is there at least a one inch slope toward the column in the steam connection and the same slope toward the drum in the water connection? (if column is not connected direct or close to the drum).

8 If your working pressure is above 450 lbs., does the water connection opening into the drum have an inward projecting nipple at least 3 inches long? This minimizes corrosion of the drum plate.

9 Connect column as close to drum as possible, if you want to assure accurate reading of water level.

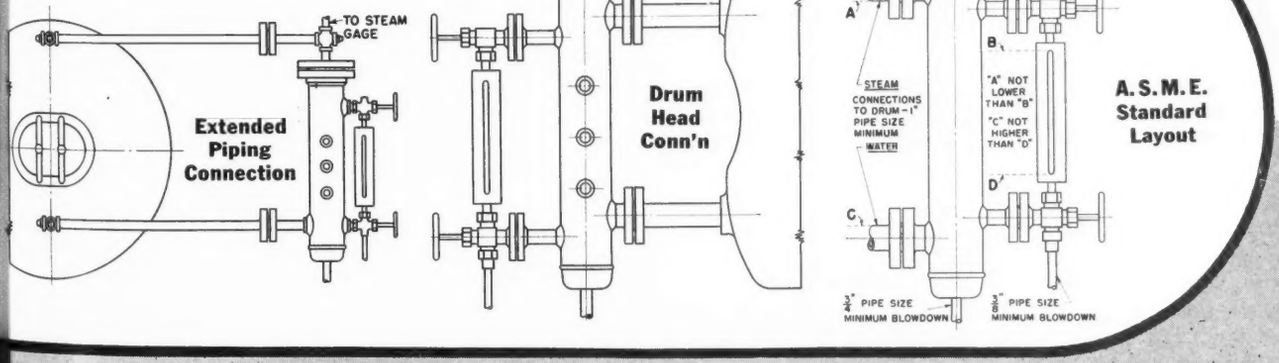
10 And for extra safety and efficiency — insulation of piping between column and drum is recommended; protect column and gage glass from excessive cooling by wind and rain; provide safe and easy access to all sides of water column by platform gratings.

CHECK *ALL* YOUR EQUIPMENT—

your instruments, pumps, feed water regulators, water level gages and other controls. • In the May issue of Power, the Reliance advertising pages carried suggestions on *maintenance* of water columns and accessories. If you did not see this material, write for reprint to

The Reliance Gauge Column Co.
5902 Carnegie Ave. Cleveland, Ohio

Typical water column hookups for boilers operating above 250 lbs.



BOILER SAFETY DEVICES

SURFACE CONDENSERS
FEED WATER HEATERS
EVAPORATORS EJECTORS

BY

LUMMUS

As a leading designer and builder of complete refineries, Lummus was for years the largest single purchaser of heat transfer equipment. In a 40,000 barrel per day refinery, for example, heat exchangers, lube oil coolers, etc., will amount to more than half a million dollars.

With a view to securing heat exchangers and similar equipment of improved design, made to even higher standards of precision and workmanship, Lummus decided to make — and for four years has been producing — heat exchange equipment for the plants it designed and built.

Recent expansion of the Lummus heat exchanger plant at Honesdale, Pennsylvania, makes available a limited capacity for surface condensers, feed water heaters, evaporators, ejectors and similar equipment for the public utility and power fields. In addition to improved design and new standards of precision, public utilities and power plants are offered the services of Lummus engineering personnel for the study of specific problems and the design and construction of Lummus-built equipment to meet definite conditions. Requests for further information will receive prompt attention.

THE LUMMUS COMPANY · 420 LEXINGTON AVE., NEW YORK, N. Y.

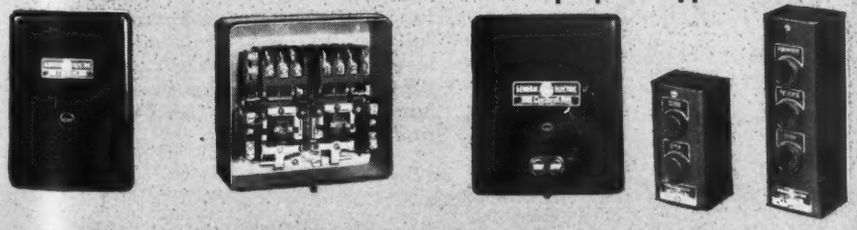
LUMMUS

THESE MAGNETIC STARTERS ARE AVAILABLE FOR *PROMPT DELIVERY* FOR WAR WORK

CR7006-D50 Full-voltage Starter
Three-phase; 110 volts, 1 1/2 hp maximum; 220 to 600 volts, 2 hp maximum

CR7006-D51 Full-voltage Starter
Three-phase; 110 volts, 3 hp maximum; 220 volts, 5 hp maximum; 440 to 600 volts, 7 1/2 hp maximum

Starters for Machine Tools and General-purpose Applications



Enclosed CR7006-D50 Starter
Three phase, 110 volts, 1½ hp maximum; 220 to 600 volts, 2 hp maximum.

CR7009-B31JD Magnetic Reversing Starter
Three-phase, 110 volts, 3 hp maximum; 220 volts, 5 hp maximum; 440 to 600 volts, 7½ hp maximum.

Enclosed CR7006-D51 Starter with Push-button in Case
Three-phase, 110 volts, 3 hp maximum; 220 volts, 5 hp maximum; 440 to 600 volts, 7½ hp maximum.

CR2943 Push-button Stations
These accessory stations are available for either START-STOP or FORWARD-REVERSE-STOP service.

JUST pick up your phone and call the nearest G-E office. Tell us your priority rating and the type of starter you want. In most cases, we'll be able to have your starter, or starters, on the way to you before the end of the day.

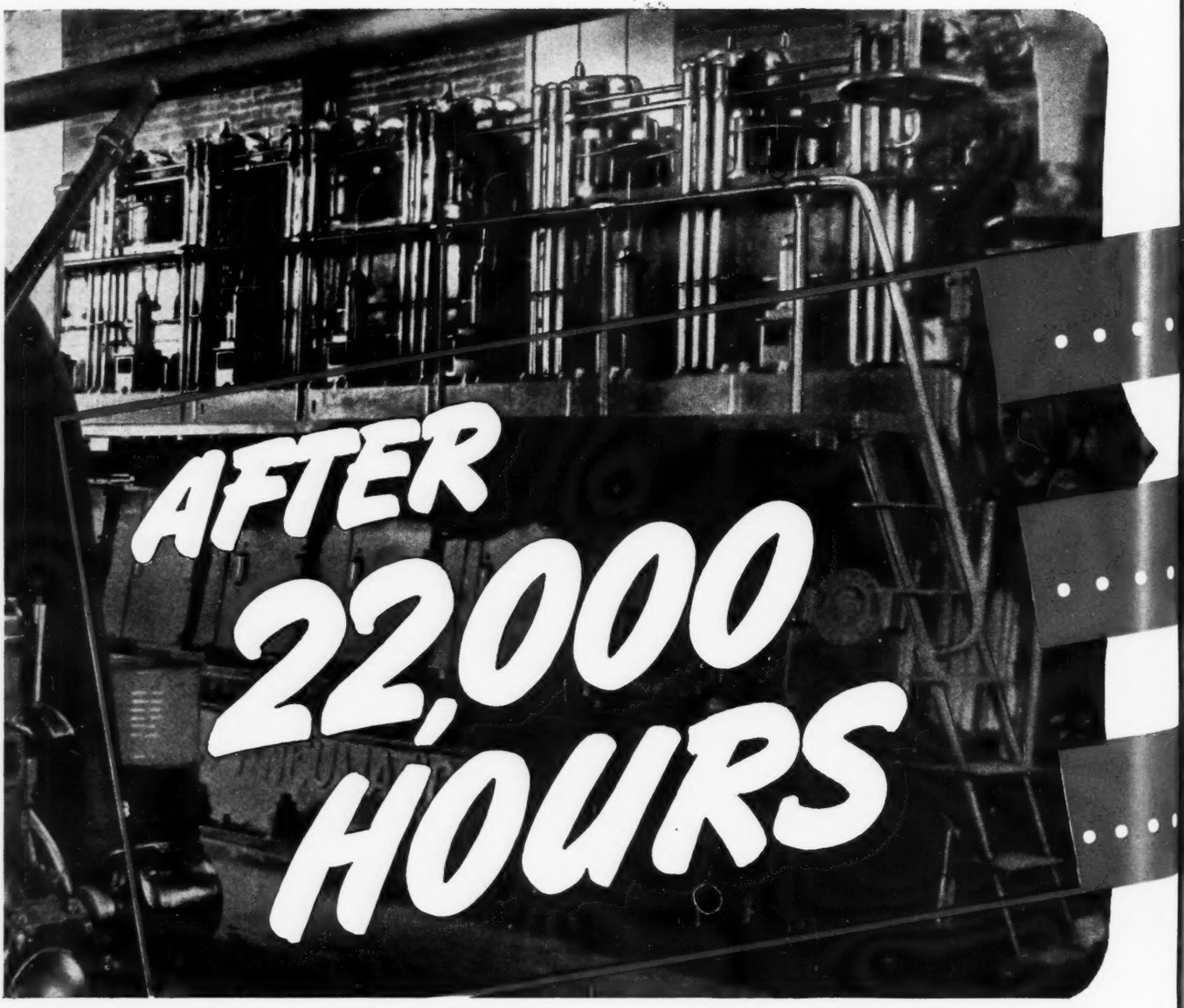
Centrally located warehouses which carry an ample stock of the popular sizes and types of magnetic starters make this kind of service possible.

When you need motor control in a hurry, call your local G-E salesman. In most cases he will have just what you need in stock. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

676-42-8490

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.



"Piston ring wear has been very slight ... tool marks still visible on compression rings below the top two ... ring grooves in pistons still have original dimensions.

"Extremely small cylinder wear is remarkable, as average wear over period of 22,000 hrs. is only .00025" per 1000 hrs. operation!"

Supt. A. Lee Bland further reports "oil consumption at minimum" in this 8-cyl., 800-hp. Chicago Pneumatic Diesel. It has been lubricated with *Texaco Ursa Oil* from the start.

TEXACO

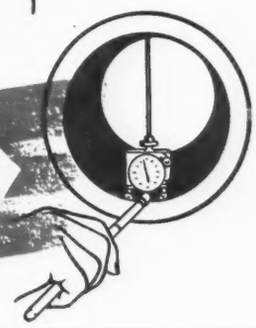
REG. T. M.

TEXACO

TOOL MARKS STILL VISIBLE HERE

Original Dimensions Here

4,000 Hrs. per .001" Wear Here



SO runs the report, from Supt. A. Lee Bland, on the remarkable freedom from ring, groove, and liner wear in this 800-hp. Chicago Pneumatic Diesel at Blackstone, Va.

Since installation in 1937, this Diesel has been lubricated exclusively with *Texaco Ursa Oil.*

Highly resistant to the formation of gum, sludge and hard carbon, *Texaco Algol and Ursa Oils* keep piston rings free, valves clean, ports open. Result:

More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

The outstanding performance that has made Texaco first in the stationary Diesel field, has made it first in the fields listed in the panel.

These Texaco users enjoy many benefits that can also be yours. A Texaco Lubrication Engineer will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distribution points in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York, N. Y.

Care for your Car ..for your Country

THEY PREFER TEXACO

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

Tune in the TEXACO STAR THEATRE every Sunday night —CBS

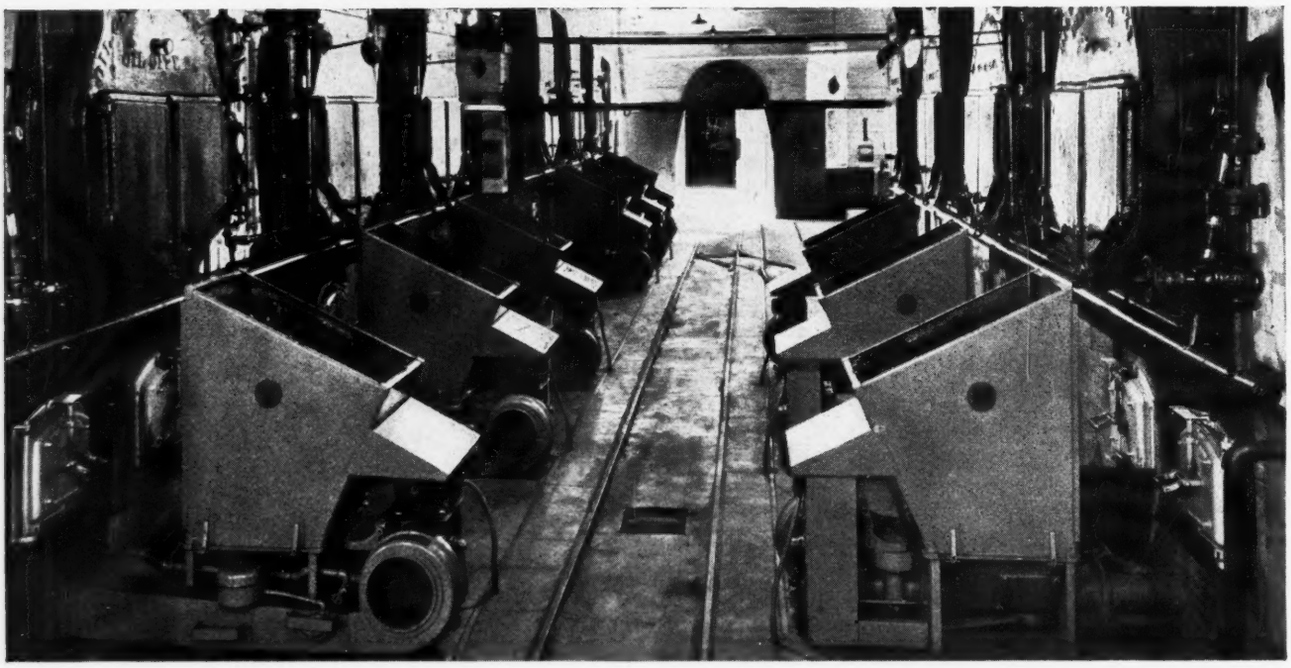
HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Lubricants and Fuels

FOR POWER PLANT EQUIPMENT

Fire Power

24 Hours a Day . . . 7 Days a Week with Iron Fireman *POWERAMS*



Nine Powerams in the Bear Creek Oil Pumping Station of National Transit Co. (A 10th unit has been added since above photograph was made.)

National Transit Company Operates 10 Powerams

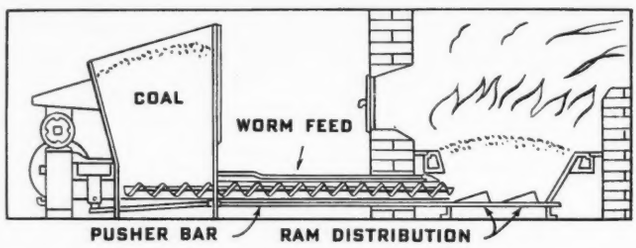
WARTIME operating conditions demand greater fire power—*more reliable* fire power—than ever before, and Iron Fireman heavy duty industrial stokers *are delivering it.*

Urgent war needs make it necessary to operate the Bear Creek Oil Pumping Station of the National Transit Company, Parker's Landing, Pa., at top efficiency, month in and month out, 24 hours a day, seven days a week.

Here Iron Fireman Poweram underfeed stokers are maintaining a steady steam pressure, under heavy load conditions which enables the pumps to operate continuously, at top capacity.

Not only has the National Transit Company been able to cut fuel costs, but substantial coal tonnage is being saved, thus aiding our national war program.

Iron Fireman stokers are shipped from the factory complete with fans and automatic controls. Installations are quickly made. For full information, without cost or obligation, wire or write Iron Fireman Manufacturing Company, 3307 West 106th Street, Cleveland, Ohio.



To meet the most varied industrial firing requirements, 41 standard catalog sizes and models of Iron Fireman stokers are available. These include both underfeed and pneumatic spreader types, and hopper and bunker-feed models. Iron Fireman engineering assures you of the correct stokers for your plant, taking into account fuel, load and operating conditions.

Iron Fireman *Poweram* stokers, installed at the Bear Creek Oil Pumping Station combine worm feed with ram distribution of coal. The worm conveyor delivers the coal to the retort in a loose, easily-aerated condition. Reciprocating ram blocks distribute coal evenly, for efficient combustion, and prevent the packing of fuel. This type of stoker gives outstanding performance under heavy, continuous load conditions.

IRON FIREMAN AUTOMATIC COAL STOKERS

4 SIMPLE STEPS *to Save*

★Months of Time *and* ★Tons of Vital Materials

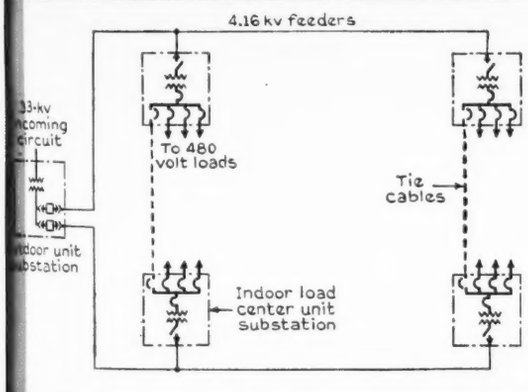
—in Getting Electric Power to New Production Machinery

1. Decide on a modern load-center distribution system using load-center unit substations.

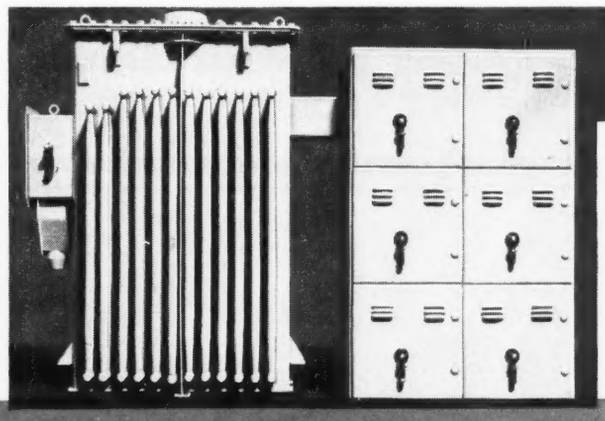
2. Make a simple, one-line electrical layout of your proposed plant.

3. Specify standard equipment; standardization means you get better equipment more quickly and at lower cost.

4. Order your electric equipment as soon as possible so that it will be available for immediate installation when construction has progressed far enough.



A typical one-line diagram of a load-center distribution system, with power being distributed at high voltage (2.4 to 13.2 kv) to unit substations located near the centers of electrical load areas—eliminating long, heavy, low-voltage feeders from a distant large substation. Thus, you save tons of copper, and the performance of motors, lamps, etc., is improved because of the reduction in voltage drop.



Factory-assembled, safety-metal-enclosed unit substations are quickly and easily installed right at load centers—without expensive vault construction, thanks to Pyranol. Simply slide the completely assembled sections into position and connect to the primary and secondary cables.

BY following these steps in General Electric's plan to provide standard load-center distribution equipment in the shortest time possible, you can save from *one to six months* of the time ordinarily required. You eliminate hours and hours at the drawing board, and long, drawn-out correspondence.

What's more, load-center distribution saves tons of steel, copper, and other vital materials; installation time is quicker, and service better.

To help you get your equipment specified, purchased, and installed under this new, short-time plan, a new "handy guide" is just coming off the press. Mail the coupon for your copy today.

General Electric, Schenectady, N. Y.

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance

GENERAL ELECTRIC

General Electric Co., Sec. C 302-10
Schenectady, N. Y.

I understand your new handy guide to "Quickly Installed Electric Power Systems" (GED-1006) explains in detail the steps to follow in order to get power to new production machinery in one to six months less time. Please send me a copy.

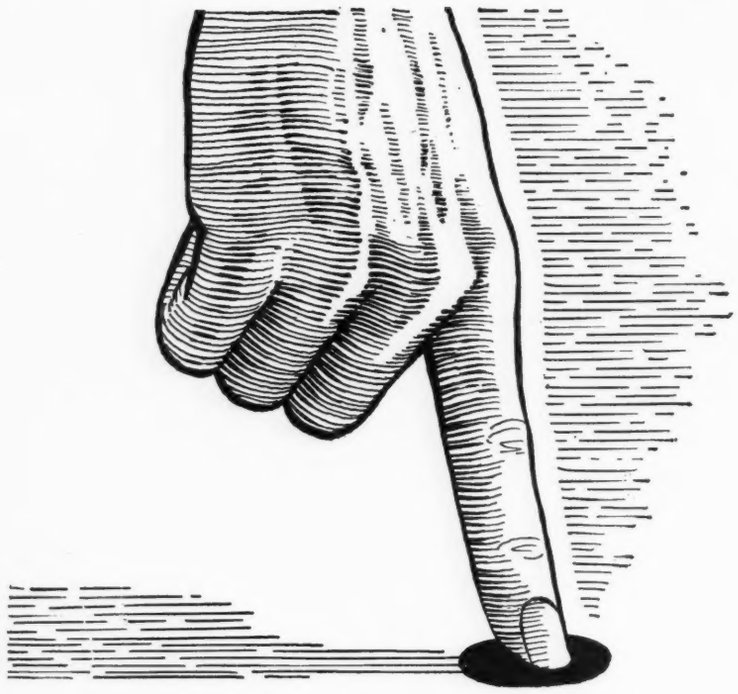
Name.....

Company.....

Address.....

City..... **State**.....

302-10-170E



CAN YOU PUT

Your Finger

ON POTENTIAL TROUBLE SPOTS BEFORE THEY HAMPER PRODUCTION?

✲

EVERY power plant or process is a chain of equipment elements in which some "weak link" may limit the capacity or its failure cause a shut-down of the entire plant. Can you put your finger on these potential trouble spots as they develop, before they get into the emergency class and disrupt production schedules?

Flow meters are bloodhounds for spotting faulty conditions as soon as they occur. An installation of boiler and distribution meters will enable you to track down these potential trouble spots long before they have a chance to become serious. This is of prime importance where the plant load is putting severe demands on both equipment and personnel.

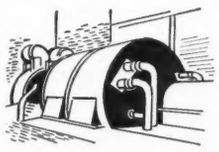
Power engineers in hundreds of industrial plants have found that the data made available by an intelligently engineered metering system has enabled them to increase the *de-*

EQUIPMENT • FACILITIES • PERSONNEL & EXPERIENCE
REPUBLIC
INSTRUMENTS
AND CONTROLS

pendable capacity of their plant by spotting and fixing weak links before they fail—and to increase the *effective capacity* of their plant by eliminating all unnecessary consumption of steam, water, compressed air, etc.
Here are a few typical examples:

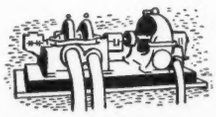
You can't improve conditions until you know what the conditions are.

TURBINE TROUBLES?

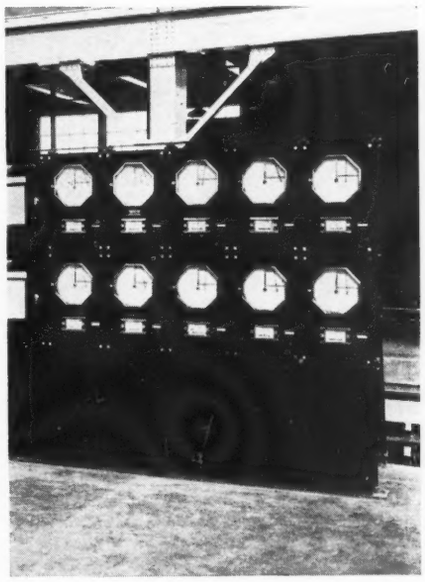


About a year after a turbine had been installed, difficulty was experienced in meeting the steam demand at certain times. Since this trouble had never arisen before, faulty operation of the turbine was suspected. Before deciding to overhaul the turbine, an expensive procedure, a Republic flow meter was installed on the turbine steam line. This meter instantly revealed that the turbine was operating within 2% of the performance guarantee and that the real trouble was in the steam generating plant. Here it was found that two of the units were delivering only 60% of their rated output. The data provided by the flow meter prevented an unnecessary turbine overhauling and placed the blame where it belonged.

PUMP TROUBLES?

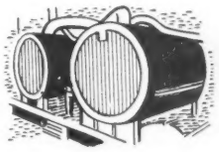


When a battery of six process water pumps failed to operate at full capacity it was necessary to dismantle them one by one to locate the trouble. This procedure required two weeks to find out what an installation of flow meters could have revealed in two seconds. Of course, there was only one answer—Republic meters now measure the discharge from each pump.



EFFECTIVE CAPACITY?

By studying steam and water flow meter records, a process plant found it possible to shut down a triple-effect evaporator completely and draw liquor of the same strength from an intermediate stage of a quadruple-effect evaporator. This change saved approximately 100,000 lb. of steam per day. Thus the effective capacity of the boiler plant was increased by this amount.



Hundreds of similar experiences recorded in our files provide overwhelming evidence of the value of Republic meters.

A COMPLETE METERING SERVICE

The Republic Flow Meters Co. offers nationwide evidence of the preference shown by industrial leaders for Republic flow meters. Whether it be in the steel industry, paper industry, chemical industry or other major industries, you will find an impressive number of Republic flow meters measuring the distribution of steam, water, gas and air.

What does this leadership mean to you? Briefly, this: when you decide—as you eventually will—to take full advantage of the assistance modern instruments can render, a statement of your aims to Republic will make available an unmatched experience, a complete range of instruments and alternative schemes to choose from. One of our engineers will be glad to call at your request, without any obligations on your part.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois

A PAIR OF I

Fig. 1640 — I. B. B. M.
"KING-CLIP" GATE VALVE
(Non-ferrous stem-thread bushing cast in the bonnet)

Fig. 1644 — All-Iron
"KING-CLIP" GATE VALVE
(Coarse integral stem-thread in bonnet with large clearance)

LUNKENHEIMER VA

IRON BODY GATE VALVES FOR CONTINUOUS SERVICE

On lines where uninterrupted service is essential—which means *all lines* in these critical times—you'll do well to use these two sturdy Lunkenheimer valves.

They are built to stand up under rough, hard usage—to stay tight and to give the added long service life so necessary now when time is so important.

You can use them to advantage in the many places where small gate valves are used. Fig. 1640 has wide application on steam, oil, gas, water and gasoline lines and Fig. 1644 on many corrosive lines.

Once installed, these quality valves will do their part well. Try a few of them in your plant.

Since virtually all materials used in the manufacture of valves are on the list of critical materials, valve users are urged to furnish the highest possible preference ratings on their orders. This will be of mutual helpfulness.

Your Lunkenheimer distributor has a supply of Catalog 78. Ask for your copy.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI, OHIO. U. S. A.

NEW YORK CHICAGO
BOSTON PHILADELPHIA

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK

VALVES BOILER MOUNTINGS LUBRICATING DEVICES

5-84-42

SHAW PREFABRICATED PIPING

for

POWER & INDUSTRIAL PLANTS

Since 1893, Benjamin F. Shaw Company has specialized in the prefabrication and installation of safe, accurate, dependable piping for power and industrial plants. Geared for fast, low-cost production, we can meet your demands for every type of prefabricated piping. We invite your inquiry.

Benj. F. Shaw II
President

BENJ. F. SHAW COMPANY

2nd & Lombard Streets, Wilmington, Delaware

PIPING FABRICATORS AND CONTRACTORS

THE RUBBER SHORTAGE IS MORE CRITICAL THAN YOU THINK

Numerous industrial rubber products now irreplaceable—except on highest priority. Crisis leads many industries to adopt G.T.M. Conservation Plan for extending life of present equipment

DURING the past few weeks thousands of plant engineers, production and maintenance experts from America's leading industries have enthusiastically approved a conservation program, to relieve the acute rubber shortage, presented at a series of nation-wide meetings held by the G. T. M. — Goodyear Technical Man.

To these key operating men the importance and necessity of an immediate, all out, rubber-conservation drive was emphasized by facts like these—

Many mechanical rubber items of wide use are no longer being made by any manufacturer.

Even goods sold on priority must now be built to wartime specifications that limit rubber content to less than standard prewar construction.

So critical is the shortage, reclaimed rubber is now on allocation. Practically all synthetic rubber is being used in military equipment.

Most serious of all, several million dollars worth of industrial rubber goods now in use will fail PREMATURELY this year through improper operation and care, judging by past experience. This will deprive plant operators of from 25% to 50% of the full performance built into these products—an irreplaceable loss to the nation.

COMPLETE MANUAL ON THE PROPER USE AND MAINTENANCE OF INDUSTRIAL RUBBER PRODUCTS—furnished free to your designated operating men.

THE G. T. M. INDUSTRIAL RUBBER CONSERVATION PLAN

The G.T.M. offers a complete, workable conservation program, based on long experience, for eliminating this unnecessary waste and insuring optimum performance from all industrial rubber products.

In factories large and small, operating men are now being taught how to prevent abuses, how to correct improper applications, how to make minor repairs that will prolong the life of industrial rubber products by means of—

"Goodyear Wages War On Waste"—the graphic educational slide film which presents, easily and clearly, recommended conservation practices.

Practical demonstrations on how to inspect, what to look for and what measures to take to correct, how to salvage hose and belts and give them new and additional use.

"Goodyear Industrial Rubber Products Conservation" manual, the concise 40-page, profusely illustrated G.T.M. handbook with practical ideas and suggestions.

Industry-wide adoption of this program would mean a minimum saving of many million pounds of rubber products this year—products that many plants will not be able to replace.

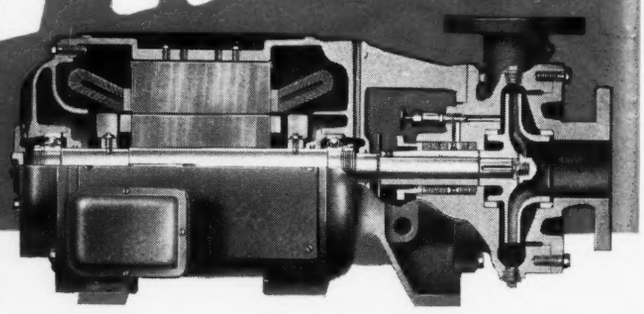
HOW TO GET YOUR PLANT STARTED

The G. T. M. will be glad to present the complete program—film, demonstrations and manual—to your plant group. If you will write us, we will set a definite date for the G. T. M. to hold a meeting at your plant. If not possible to hold a meeting, write for manual. The sooner you start the program, the more benefit you will derive from it. There is no charge for this service—it is part of Goodyear's cooperation in the nation's drive for victory. To arrange your meeting or get copy of manual, write Industrial Conservation Department C-12, Goodyear, Akron, Ohio.

THE GREATEST NAME IN RUBBER

GOODYEAR MECHANICAL GOODS

SMALL! POWERFUL! SPLASHPROOF!



New "One-Package" Pump is the Hurry-Up Answer to Your War-time Pumping Problems . . .

IT'S SPLASHPROOF! It takes up to 33% less space than most other pumps . . . its exclusive "One Package" construction permits you to install it in 50% less time than conventional pumps . . . new motor gives full-duty power — these are some of the reasons for using Allis-Chalmers Electrifugal Pumps in your plant.

Three section-fits compared to five or more for old style pumps give you a new kind of performance with less vibration . . . increased efficiency . . . rugged service that can take abuse! Positive alignment of its single shaft means less wear and tear — less lost maintenance time.

100% newly designed pump motor delivers maximum pumping power — assures dependable performance. One-piece frame takes up to 33% less space with up to 40% less overhang than conventional pumps. Indestructible rotor, distortionless stator, bronze protective sleeves, full ventilation mean full-power service on every type of pumping job.

Installation costs are far less than those of conventional pumps. End your pumping problems with this mobile, adaptable unit. Get the complete story . . . call the engineer in the district office near you . . . or write Allis-Chalmers, Milwaukee.

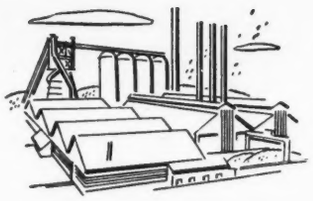
A 1530

✓ Check These Great One-Package Features

1. *Up to 33% Space Saved* with one frame, one solid driving shaft construction.
2. *Overhang Cut as Much as 40%.* Four solid supports assure precision balance . . . ease strain on vital parts.
3. *New Tri-Fit Design* eliminates 2 section fits for more positive shaft alignment, wearless and vibration-free performance.
4. *Splash-Proof* Motor standard equipment . . . 100% designed for pumping.
5. *Easy-to-Get-at* Casing simplifies stuffing box and waterseal gland inspection.

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE



Here's a *REAL* Yardstick for Control Performance!

...the Hagan job in the J&L Eliza works

THE five boilers in J&L's Eliza Furnace Department can produce a million and a half pounds of steam per hour. Automatically burning blast furnace gas, or any combination of gas and pulverized coal when gas fuel is scarce, they supply an unfailing steam supply for extremely fluctuating loads in the 96" strip mill. How they function is an engineer's dream.

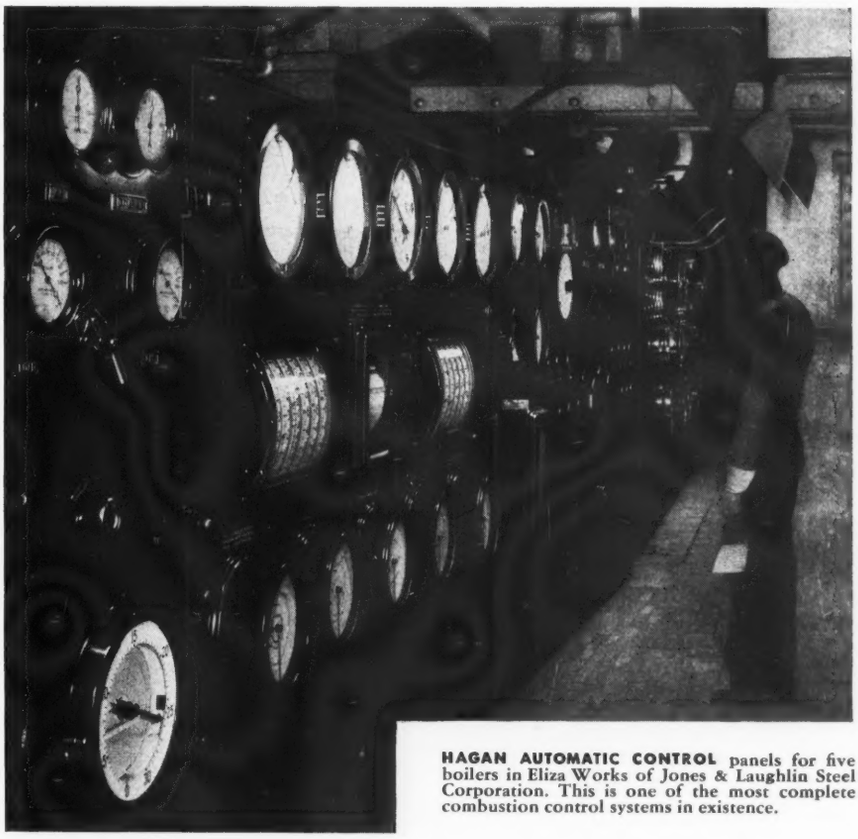
As each hot slab enters the rolls, the surging current, on the ammeter, nearly jolts the pen off the chart. In the load dispatcher's office, the recording wattmeter spins an uncanny story of instantaneous power load pick-ups of 20,000 to 25,000 kw.—and equally speedy cut-offs as the mills release their loads.

In the generating room, the turbine groans as it shoulders the violent load increases—and the steam-flow pen inks a wicked "sunburst" as it shifts with the load on a seesaw. But over near the boiler room the steam pressure chart shows maintenance of pressure at 410 lbs. *within one per cent!* Surely the boiler room gang must be working black magic to hold that pressure constant!

Along the firing aisle, on five gleaming panel boards, red and green lights flash on and off, silently signalling the *automatic* starting and stopping of powdered-coal burners, the opening and closing of dampers.

We pass one boiler and then another —not an operator is in sight. At the third boiler, one man calmly views the panel board while another man eats his lunch.

While the load is jumping all over the lot, Hagan Automatic Combustion Control is on the job, ably directing the complex system of fans, burners, dampers, boilers and turbines. Hagan Control maintains maximum fuel efficiency by correctly proportioning the fuel and air.



HAGAN AUTOMATIC CONTROL panels for five boilers in Eliza Works of Jones & Laughlin Steel Corporation. This is one of the most complete combustion control systems in existence.

It distributes the load evenly among the boilers, automatically regulates drafts and pressures *without human attention.* This is *fully automatic* Hagan Combustion Control at its best—the control system that thinks like an engineer and acts instantly!

WHAT CAN HAGAN DO FOR YOU?

Simply this. If standard Hagan equipment can handle the J & L-type loads—admittedly unusual—and maintain maximum efficiency *continuously,* that *same* standard Hagan equipment will do the best job you ever saw in your own plant —large or small—*without* pampering. All we ask is the chance to prove it.

HAGAN CONTROL JOBS IN J&L WORKS

Eliza . . . Combustion control for five boilers. Three pressure reducing and desuperheating systems. Full automatic control on slab-heating furnaces. Blast-furnace gas bleeder control.

South Side . . . Soaking pit control. Open-hearth furnace control.

Aliquippa . . . Combustion control for blooming-mill boilers. Combustion control for coke-plant boilers. Pressure reducing and desuperheating control.

Hazelwood . . . Combustion Control for coke-oven boilers.

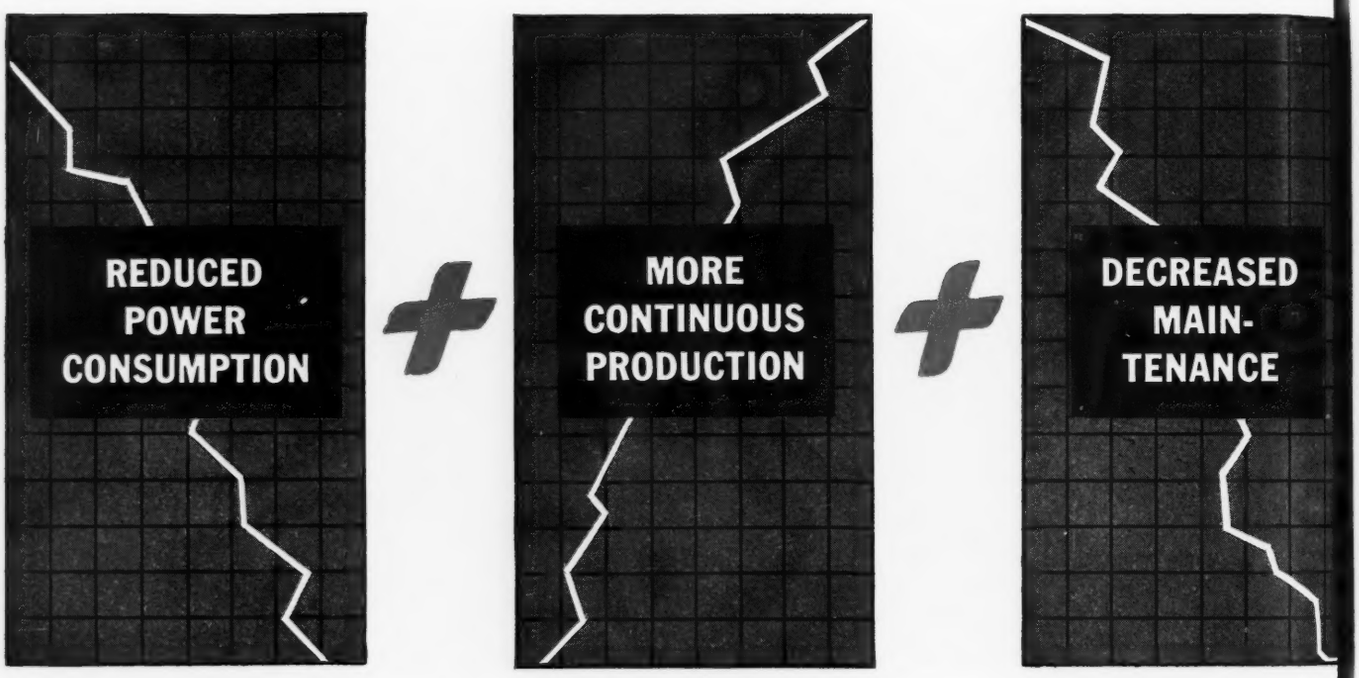
HAGAN CORPORATION · 300 ROSS STREET · PITTSBURGH, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader

SOCONY-VACUUM'S FAMOUS LUBRICATION

Capacity



The "4-Factor" Story proved in Peacetime—Now vital in Wartime

GARGOYLE Lubricants

NEVER BEFORE IN U. S. A. HISTORY has there been such grim, absolute necessity for Correct Lubrication. It's a keystone in our Battle of Production. Without it no plant can achieve full efficiency.

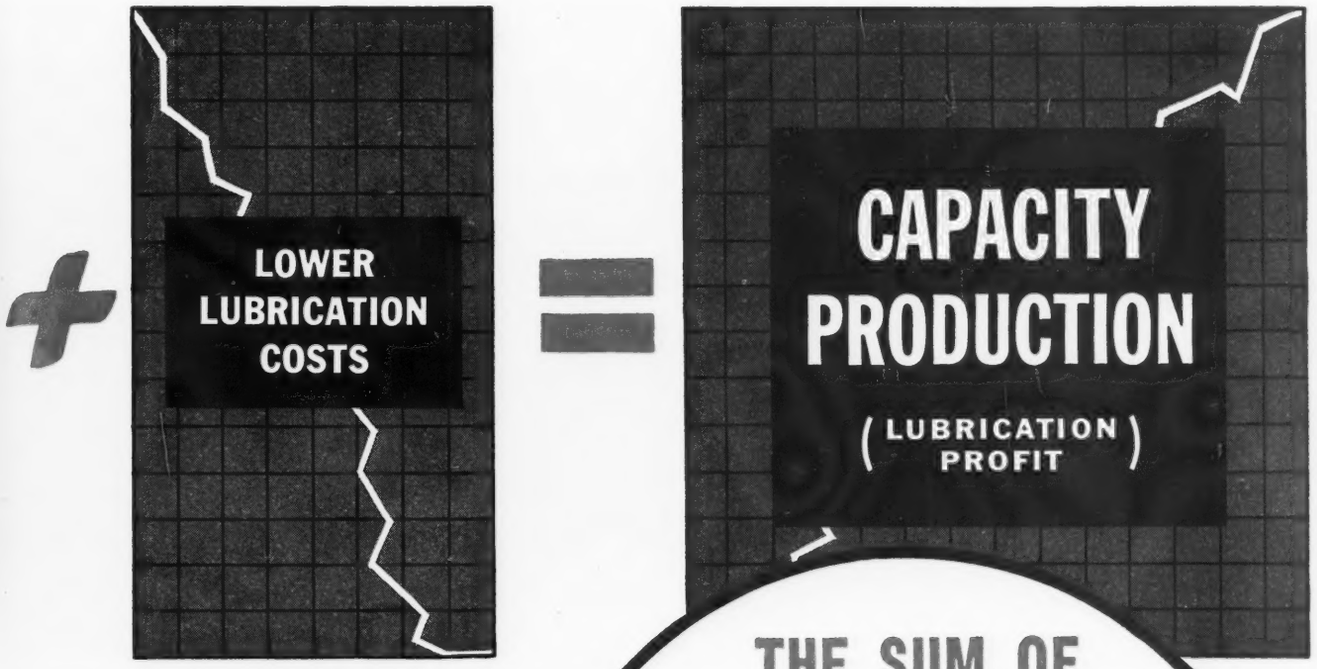
For years Socony-Vacuum—*the first to present and apply the principle of Correct Lubrication*—has been proving to management that it results in 4 savings which add up to a Lubrication Profit. Today, this Lubrication Profit pays off in Capacity Production!

If you are interested in results, talk this over with the Socony-Vacuum man. Backed by 76 years' experience, no one in the lubrication field is better equipped than he to give you the results you want!

CALL IN SOCONY-VACUUM FOR CORRECT

PROFIT NOW PAYS OFF IN...

Production!



Socony-Vacuum's 4-FACTOR STORY is a Famous guide for operating men throughout U.S.A. Industry

THE SUM OF THESE FOUR SAVINGS

4

1. REDUCED POWER CONSUMPTION
2. MORE CONTINUOUS PRODUCTION
3. DECREASED MAINTENANCE
4. LOWER LUBRICATION COSTS

= LUBRICATION PROFIT

SOCONY-VACUUM OIL CO., INC. • Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) Magnolia Petroleum Co. • General Petroleum Corp. of Calif.

T LUBRICATION

Data on Relaxation Resistance of Nickel Alloy Springs

Report presented at 1941 Annual Meeting of the American Society of Mechanical Engineers now available in printed form

The oxidation and corrosion resistance of INCO Nickel Alloys, combined with ability to retain strength at elevated temperatures, have made them useful in many elevated-temperature spring applications. When load loss at temperatures from 300° F. to 700° F. is a criterion, "K" Monel, "Z" Nickel and Inconel are comparable to high-alloy spring steels, while Monel is more nearly comparable to low-alloy steels.

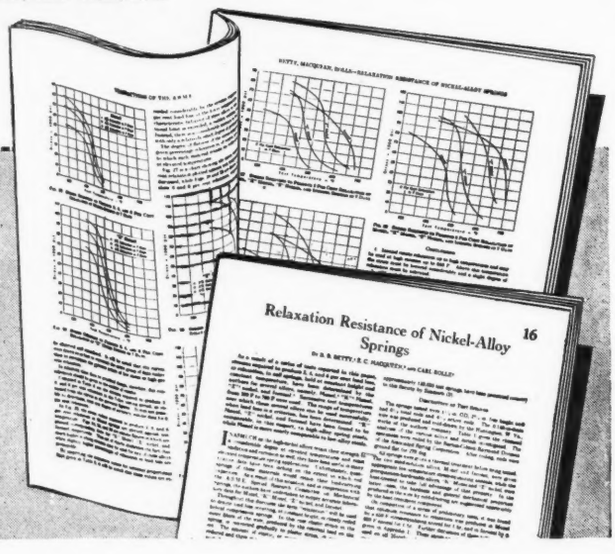
Members of the INCO Laboratories and Development and Research Division, in cooperation with the A.S.M.E. Special Research Committee on Mechanical Springs, have now furnished accurate laboratory data for Monel*, "K" Monel*, "Z" Nickel*, and Inconel*, which point to the following conclusions:

1. Inconel resists relaxation up to high temperatures and may be used at high stresses up to 650° F. Above this temperature the stress must be lowered considerably and a slight degree of relaxation must be tolerated.
2. "Z" Nickel and "K" Monel will withstand higher stresses than Inconel at the lower temperatures, consistent with their generally higher level of mechanical properties.
3. "Z" Nickel may be used with high stress at temperatures up to 550° F. and with reduced stress up to 600° F.
4. "K" Monel may be used with high stress up to 450° F. and reduced stress up to 500° F.
5. Where other factors such as corrosion resistance are involved, Monel offers possibilities as a spring material for temperatures up to about 400° F. and at moderate stress levels.
6. Monel springs should be stress-equalized for 1 hr. at 650° F. where relaxation resistance is desired.
7. Inconel springs should be stress-equalized for 1 hr. at 900° F. for service at elevated temperatures.

Complete technical information on this subject has been published in bulletin form. You are invited to send for this paper by using the coupon below.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

"Monel" and other trade-marks which have an asterisk associated with them are trade-marks of The International Nickel Company, Inc.



THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York, N. Y.

Gentlemen: Please mail me a copy of the paper "Relaxation Resistance of Nickel Alloy Springs" (B. B. Betty, E. C. MacQueen, and Carl Rolle)

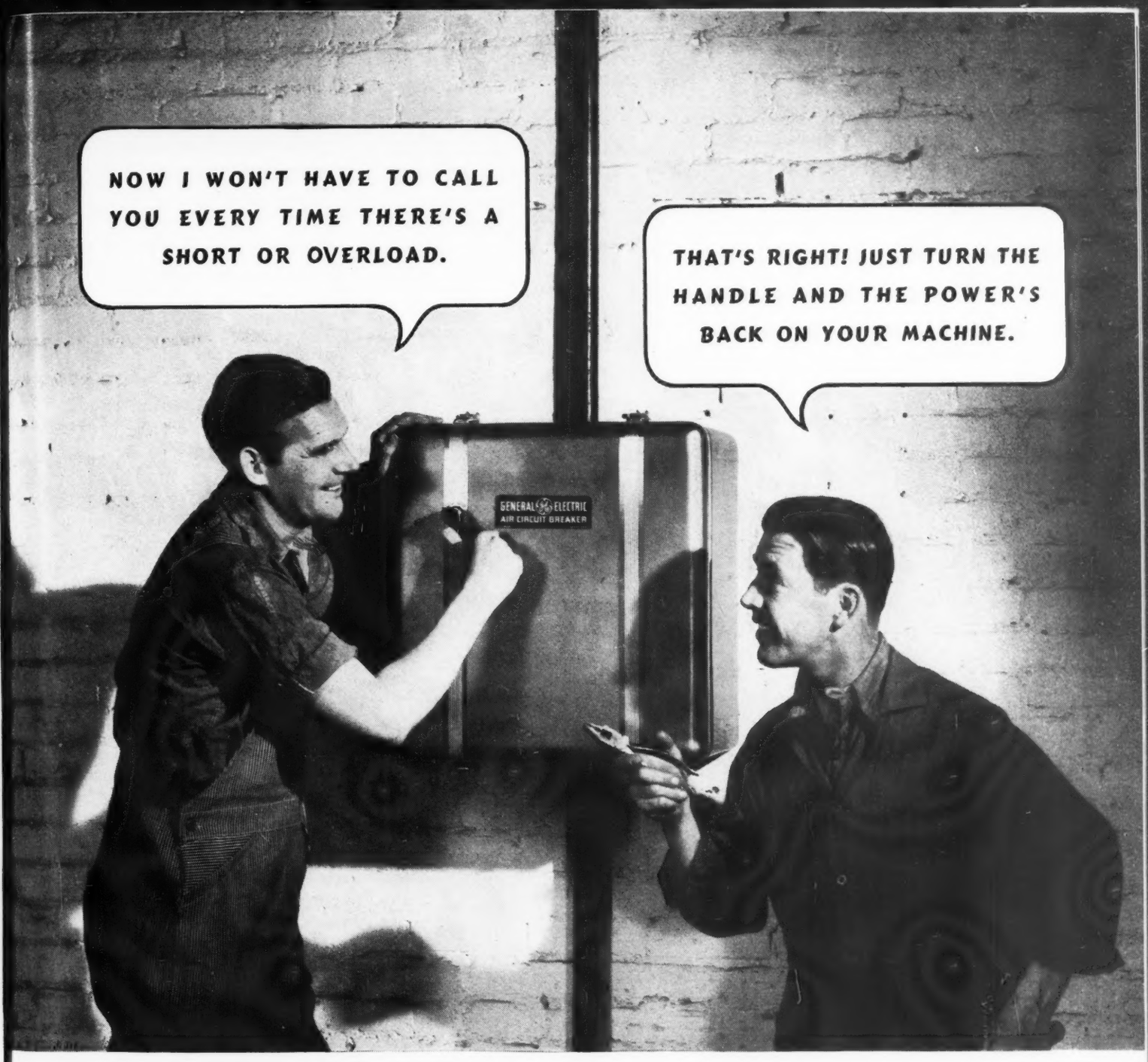
Name_____

Title_____

Company_____

Address_____

P 7-42.

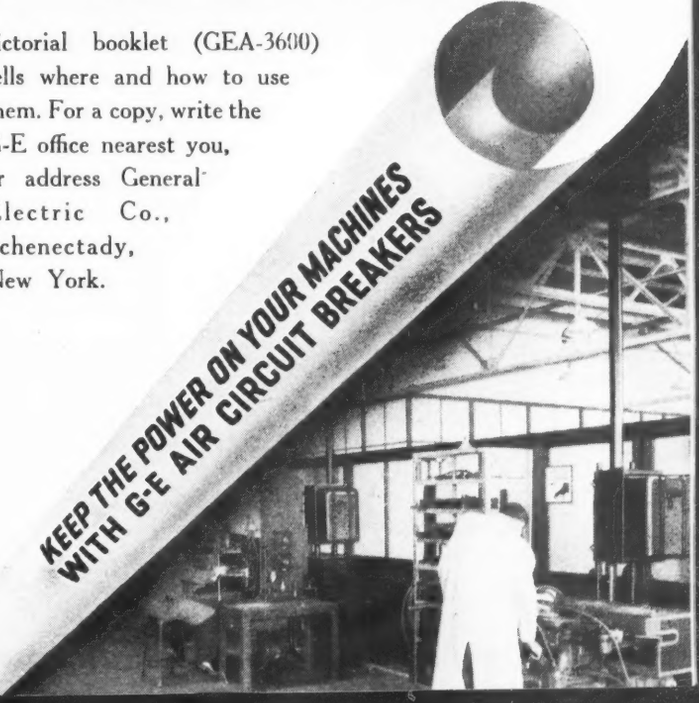

NOW I WON'T HAVE TO CALL YOU EVERY TIME THERE'S A SHORT OR OVERLOAD.
THAT'S RIGHT! JUST TURN THE HANDLE AND THE POWER'S BACK ON YOUR MACHINE.
GENERAL ELECTRIC
AIR CIRCUIT BREAKER

Here's Why YOU'LL Like This New G-E Removable Breaker

WITH this *3-minute* breaker you can re-establish service after temporary faults in less than *one* minute. You can remove and inspect the breaker unit—in safety, away from live parts—in less than *two* minutes. And where load conditions have changed, you can interchange breaker units in less than *three* minutes.

This air circuit breaker is built to meet today's demands for quick installation and provide dependable protection for defense production lines. Its new features include a simple, ingenious method of mounting and a convenient modernized enclosing case, which combine to give you a removable dustproof breaker that is easy to install, easy to operate, and easy to inspect.

Give your production, equipment, and personnel complete protection. Install these breakers in lighting, power, and motor circuits—up to 600 volts. They will protect both the circuit wiring and the apparatus connected to the circuit. A new pictorial booklet (GEA-3600) tells where and how to use them. For a copy, write the G-E office nearest you, or address General Electric Co., Schenectady, New York.

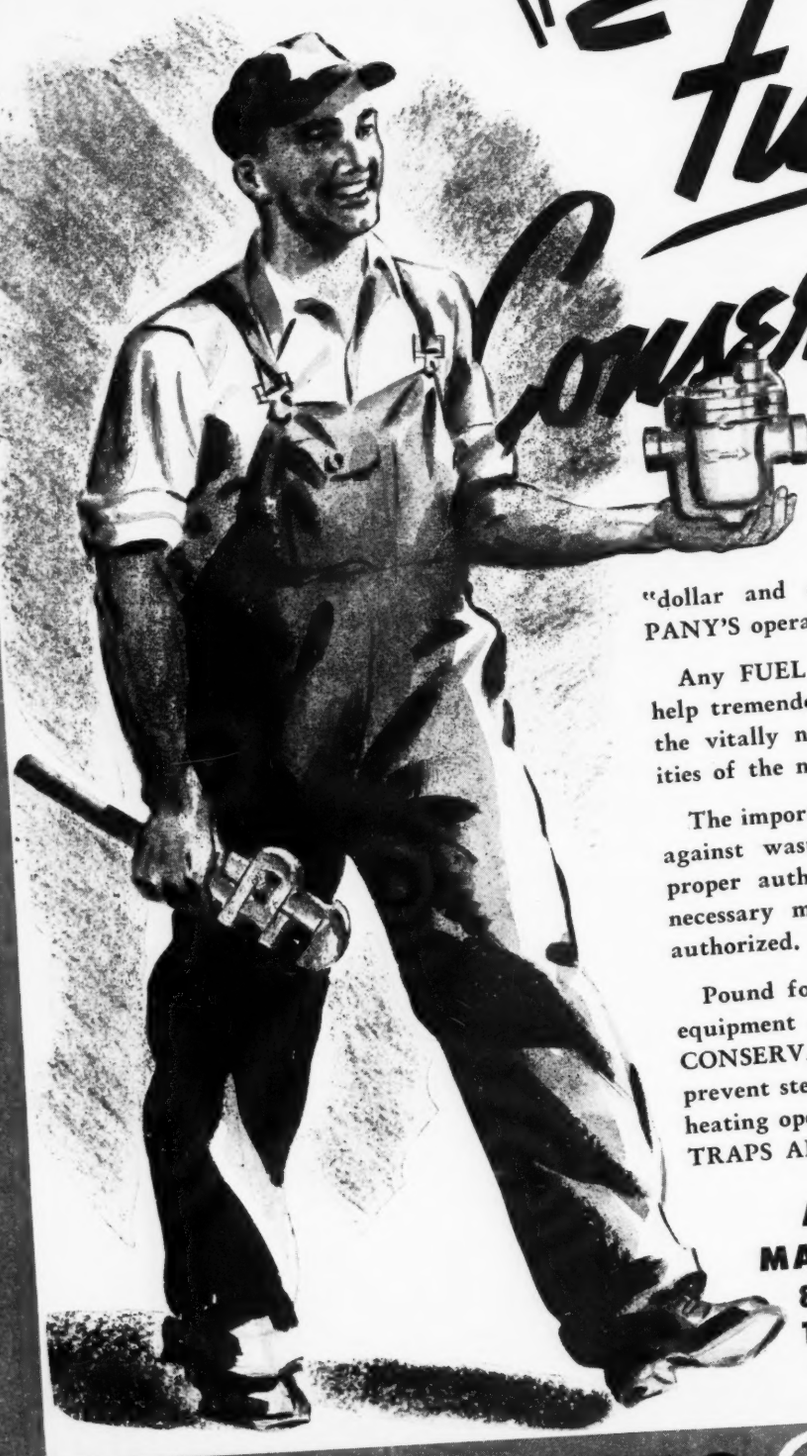


GENERAL ELECTRIC

860-21-7500

THE BREAKER WITH THE DISCONNECT FEATURE

ARMSTRONG



"Fuel Conservation"

THIS year, FUEL WASTE is more than just a matter of "dollar and cents" on YOUR COMPANY'S operating statement.

Any FUEL SAVINGS you can make help tremendously in easing the load on the vitally needed transportation facilities of the nation.

The importance of protecting industry against waste has been recognized by proper authorities and to this end all necessary maintenance and repairs are authorized.

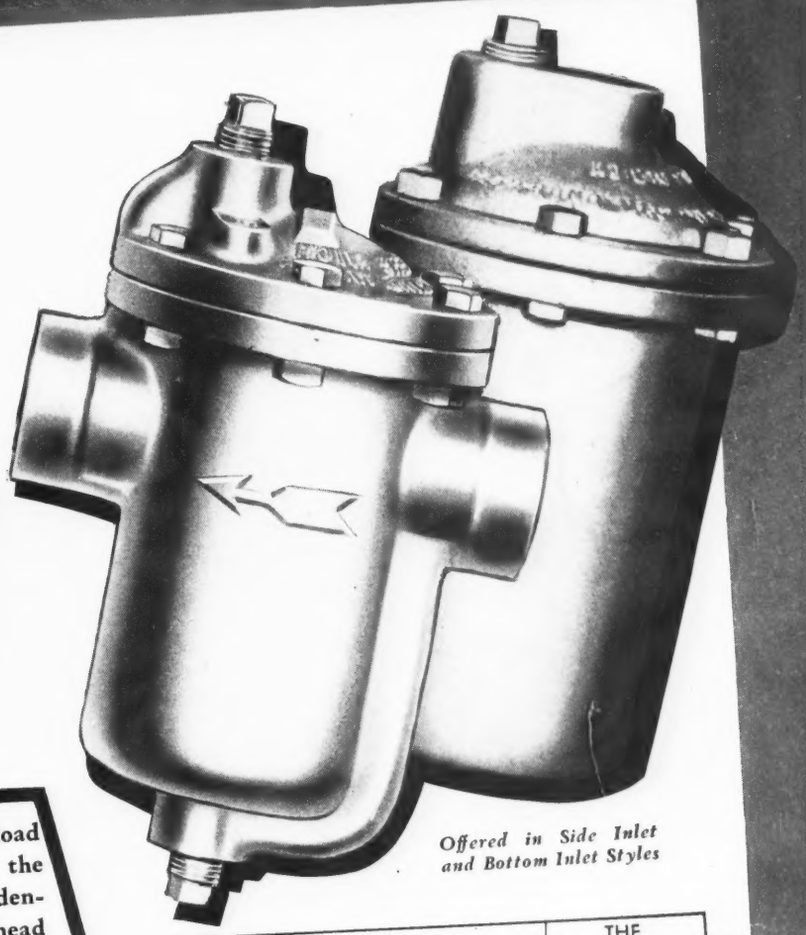
Pound for pound, few items of plant equipment are so important to FUEL CONSERVATION as the traps used to prevent steam loss in power, process, and heating operations. MAKE SURE YOUR TRAPS ARE IN GOOD REPAIR.

ARMSTRONG MACHINE WORKS
812 Maple Street
Three Rivers, Mich.

ARMSTRONG *Inverted Bucket*

begins

HERE



Offered in Side Inlet and Bottom Inlet Styles

NO STEAM LOSS

The Armstrong Trap is suitable for variable load conditions and no steam passes through the discharge orifice even when there is no condensate load. No cooling legs are required ahead of an Armstrong Trap. Condensate is discharged as fast as it forms.

TIGHT-CLOSING VALVE

Armstrong traps feature the famous "Free Floating" valve: no fixed pivots . . . virtually no wear . . . no throttling of orifice, no wire-drawing . . . snap action closing . . . hemispherical valve seats perfectly every time.

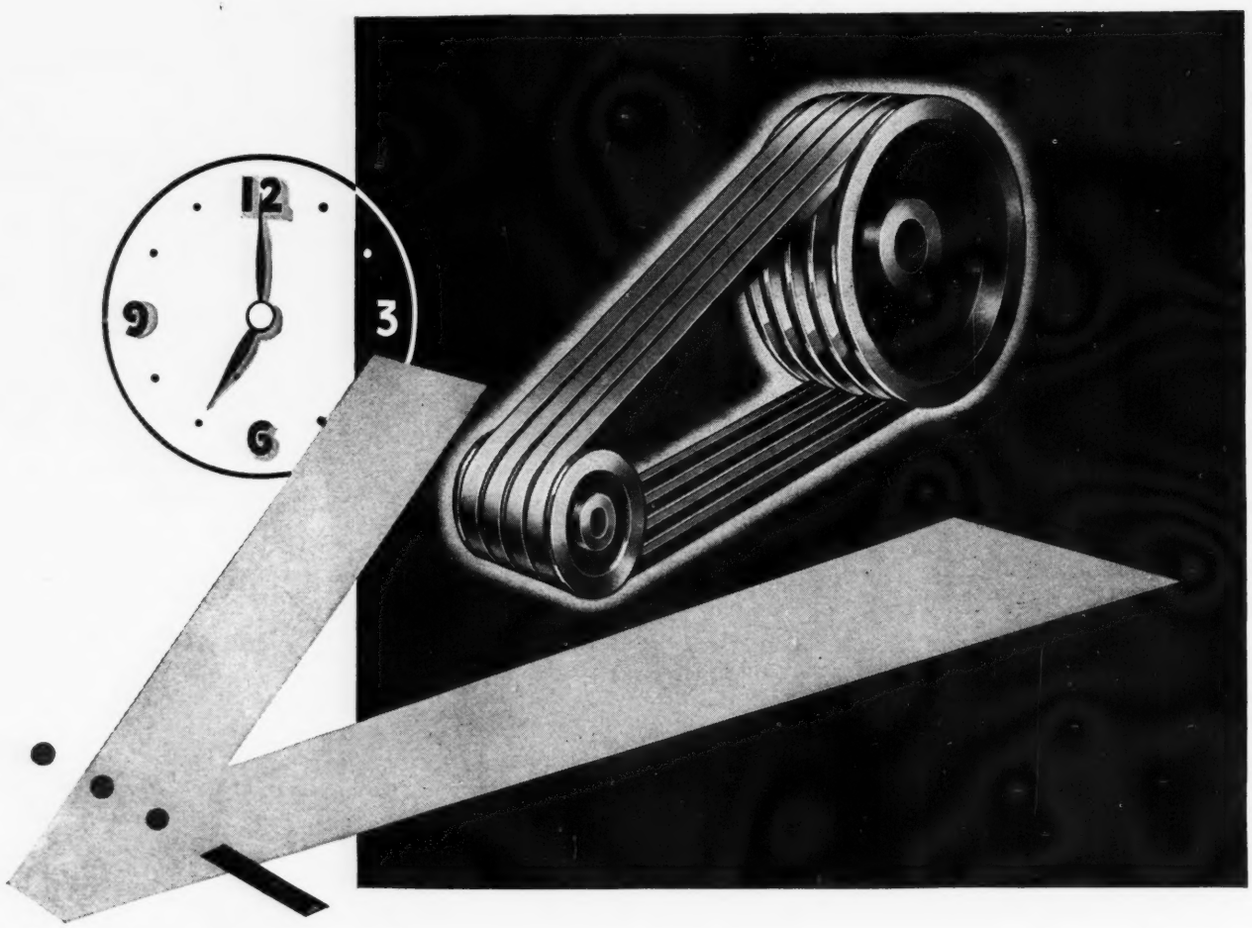
FAST HEATING

Quick condensate removal and automatic air elimination make unexcelled heating speed possible for every installation. Maximum leverage makes it possible to use large discharge orifices. Blast type buckets available for extra-fast air removal. *Ask for latest catalog.*

FEATURES Operating Engineers want in Steam Traps:	THE ARMSTRONG STEAM TRAP:
1. Ability to draw off air.	✓ YES
2. Ability to handle hot condensate.	✓ YES
3. Ability to handle all ordinary sediment and sludge.	✓ YES
4. Freedom from wire-drawing in orifice.	✓ YES
5. No steam loss for any load condition.	✓ YES
6. Ability to hold tight against vacuum.	✓ YES
7. Freedom from friction and wear.	✓ YES
8. Small size — light weight.	✓ YES
9. Simple construction.	✓ YES
10. Large capacity.	✓ YES

STEAM TRAPS

Saving Fuel, Metals and Manpower for the Battle of Production



The Dominant Drive is the "Victory" Drive

IF PROOF were needed, the present battle for production has definitely demonstrated the superiority of the multiple v-belt drive. In thousands of plants from coast to coast, it has played a most important part in helping men and machines to meet and exceed "impossible" production schedules.

Such outstanding performance under urgent demands for more of everything, in less time, has made the Dominant Drive of Industry, the *Victory Drive,* as well.

The members of the Multiple V-Belt Drive Association are happy and gratified that the years of experiment and testing, the interchange of engineering data, and the standardization of sheave and belt sizes, made the Victory Drive available to war producers, particularly at a time when the need for super-efficient power transmission is so vital.

The use of this emblem by an association member in connection with Multiple V-Belt Drives is your assurance of mechanical excellence — the result of co-operative engineering, research and experience.

MULTIPLE V-BELT DRIVE ASS'N

TRADE MARK

MULTIPLE-V-BELT DRIVE ASSOCIATION
140 SOUTH DEARBORN STREET • CHICAGO

ACTS YOU NEVER KNEW [BEFORE] BOUT WATER-COOLED STOKERS

One User Tells Another User-to-be

"In answer to your inquiry, I cannot speak too highly of our Taylor Water-Cooled Stoker. Coals that we found undesirable on the old air-cooled stokers were found to give excellent and highly pleasing economic results when used on the Taylor Water-Cooled Stoker. Our unit has been in operation for just two years... We have never had an emergency shut down of the unit, to this date. We have not made a single parts replacement on the stoker and from all appearances, barring accidents, there will not be any for a long time. In all, the equipment has done much more than we expected of it; surely it is more than just another stoker."

PROPOSITION

A large Ohio plant faced the problem of selecting firing equipment which would combine, among other important factors, reliability, fuel flexibility, and efficient generation over a wide steaming range —burning the Ohio coals economically available.

PURCHASE

After a careful investigation of many types of firing equipment, the underfeed principle combined with water cooling demonstrated proven results under similar and actual operating conditions which showed promise of exceptional performance.

This plant, therefore, decided to install a Taylor Water-Cooled Stoker, capable of generating a maximum of 150,000 lbs. of steam per hour at 200 lbs. pressure. Total steam temperature: 525°F. The pressure parts were designed for future operation at 450 lbs., 750°F. total temperature. Other specifications called for a 1410 H.P. bent tube boiler, economizer, air pre-heater and completely water-cooled furnace.

PERFORMANCE

Period	Sept. 27, 1939 to Sept. 17, 1941
Unit in actual service, of total time	93.8%
Water evaporated	1,231,512,448 lbs.
Coal burned	125,201,845 lbs. (62,601 tons)
Actual evaporation	9.84 lbs.
Average steam pressure	180 lbs.
Average steam temperature	525°F.
Average temp. feed water to economizer	213°F.
Heat added to 1 pound steam	1,100.7 B.T.U.
Average heat value of coal	12,424 B.T.U.
Average overall operating efficiency	87.1%
Average steaming rate per hour	74,100 lbs.
Material cost for stoker maintenance	$183.00
Material cost per ton of coal burned	$.0029

CALLING ALL COALS . . . a geographical picture of the relation of typical Taylor Water-Cooled Stoker installations with respect to major coal areas of the nation.

3 Ways Better—or more

There are a dozen ways in which Taylor Water-Cooled Stokers can improve operation. Of them these three are outstanding: 1. By increasing reliability, 2. By increasing fuel flexibility, 3. By increasing operating efficiency. All the advantages, and the construction and installations of Taylor Water-Cooled Stokers, are presented in a new booklet which the coupon invites you to send for.

A-E-CO TAYLOR WATER-COOLED STOKER

A-E-CO TAYLOR STOKER Water Cooled

AMERICAN ENGINEERING COMPANY
2400 Aramingo Avenue, Philadelphia, Pa.

Please send me your Catalog W on Taylor Water-Cooled Stokers, without obligation.

*Name*_____

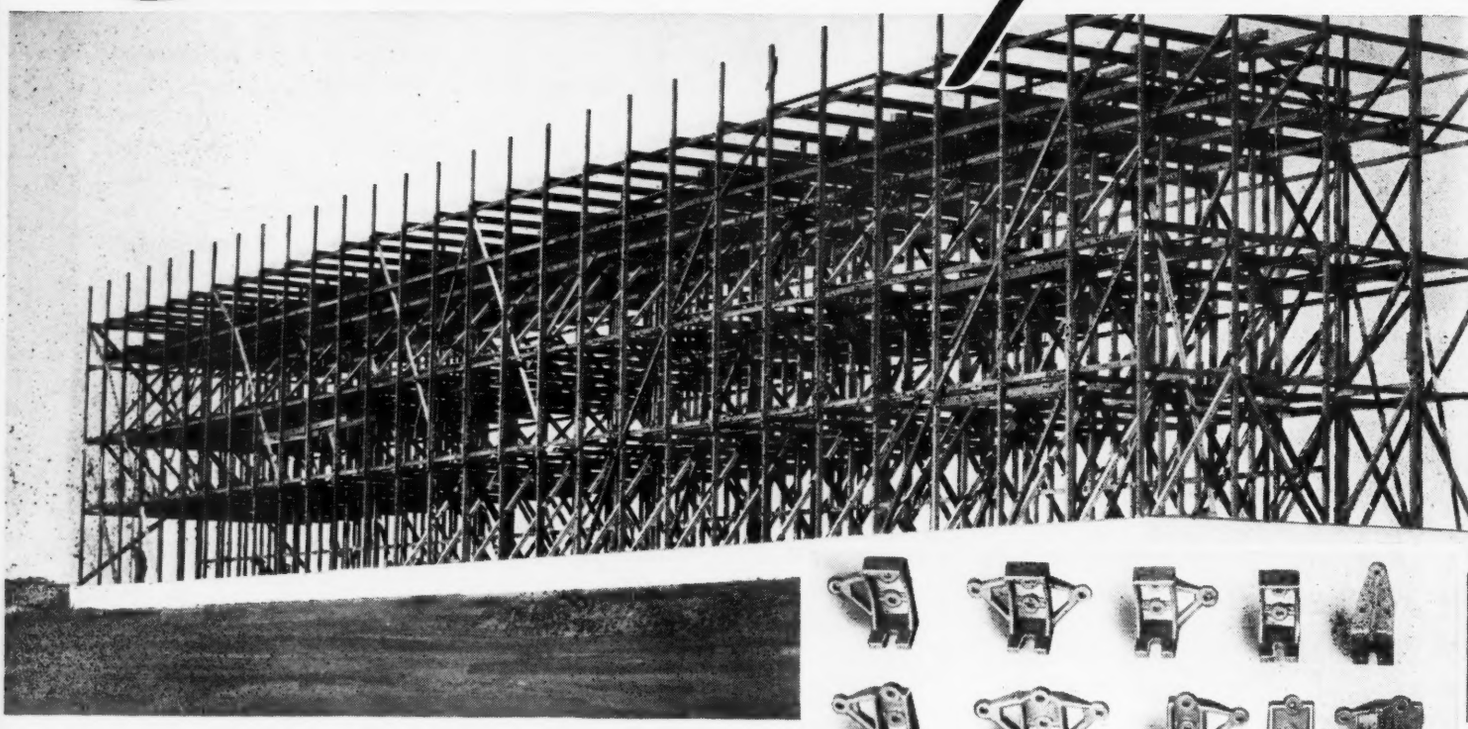
*Company*_____

*Address*_____

*City*_____

Another of MARLEY'S PLUS Features

One of a series of advertisements, each devoted to a Marley cooling tower feature that has become an accepted standard of the best practice in modern mechanical draft water cooling.



Structural strength is built into Marley Cooling Towers: (1) By proper and conservative engineering and design. (2) By using the recommendations of the *U. S. Forest Products Handbook* covering unit working stresses and other values. (3) By using materials and methods carefully determined as "best for service."

The large number of Marley towers produced, with the cumulative experience they represent, has enabled Marley engineers to establish *standardized details* for all sizes and types of towers to meet the various stresses that may be imposed or specified.

RUGGED FRAMEWORK — **As the photograph above illustrates, diagonal bracing in both directions is liberally used in addition to the many columns and struts on close centers.**

BOLTED THROUGHOUT — **Strength of all connections is developed with bolts and plates, no nails being used. Only the framework is figured to carry the stresses, partitions and casing receiving no credit.**

CAST IRON HARDWARE — **Here pictured are a few items of Marley structural hardware used as column base plates, joint connectors, etc. "Side-hill washers" provide seats for bolting through diagonals without notching. Also various castings provide bearing surfaces for butt ends of diagonals.**

These features which assure longer and safer years of service are but a few of the reasons why so many *more* cooling towers bear the Marley name.

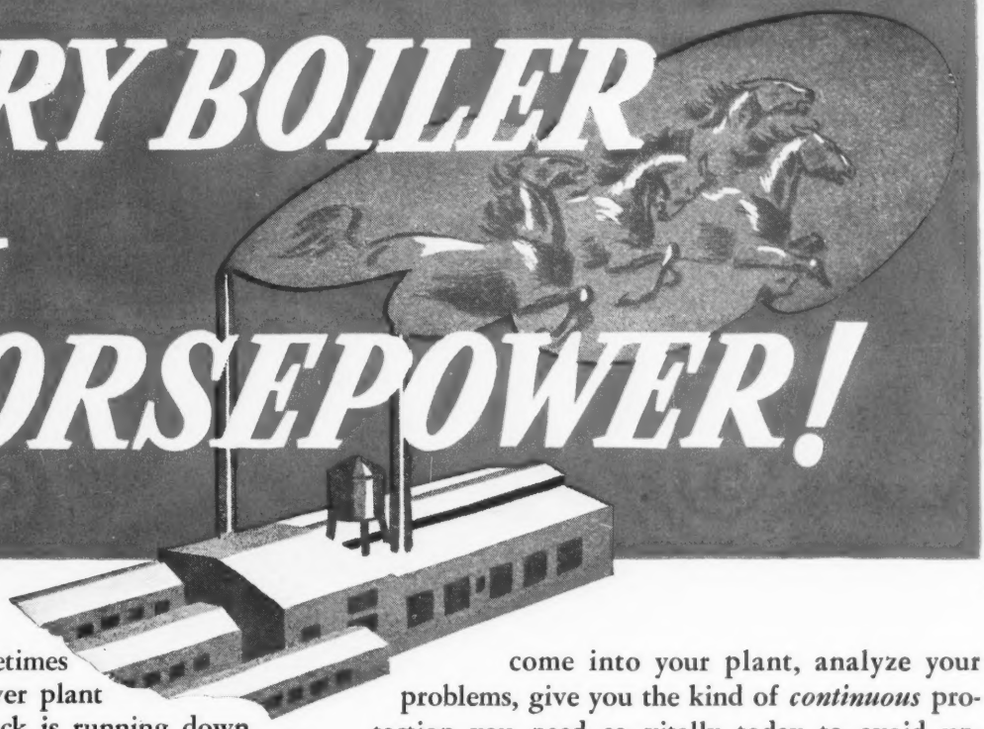
42C

MARLEY COOLING TOWERS

MARLEY TOWER ... THE MARLEY CO. INC. KANSAS CITY, KANSA

Address

Uncle Sam needs EVERY BOILER HORSEPOWER!



IT TAKES months, sometimes years, to make new power plant equipment. But the clock is running down . . .

That means power men have to use every available horsepower of capacity! And what is equally important — they must *protect* that capacity!

That's why so many power men today are coming to Allis-Chalmers Feedwater Service. As the biggest company offering a feedwater service . . . with over 60 years of power plant manufacturing experience, Allis-Chalmers is able to offer you a *complete, practical, proven* feedwater service.

With this service, trained feedwater engineers come into your plant, analyze your problems, give you the kind of *continuous* protection you need so vitally today to avoid unscheduled shutdowns. Scale, corrosion, carryover, embrittlement—these and other feedwater dangers can be licked in your plant by the Allis-Chalmers Feedwater Service!

TIME IS SHORT — get the full facts about how you can get full feedwater protection for your plant. Write for Bulletin B6133. A 1479

ALLIS-CHALMERS
MILWAUKEE·WISCONSIN

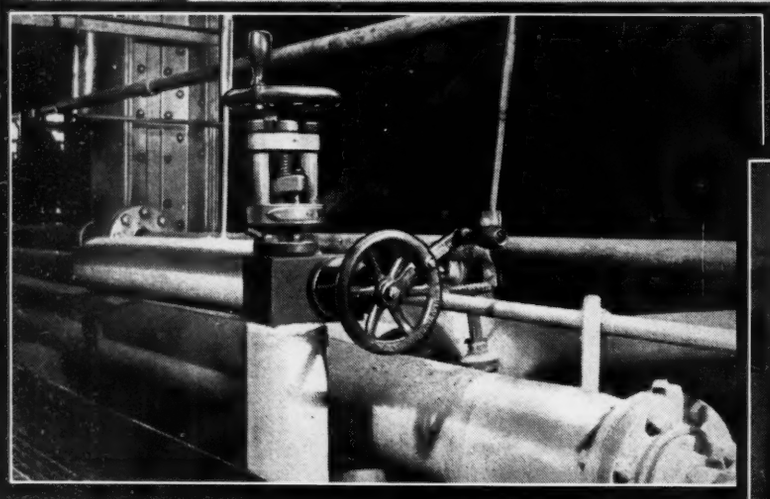
FIRST STEP — when you submit your feedwater problems to us — is for a trained Allis-Chalmers Feedwater Service Engineer to visit your plant . . . analyze your conditions . . . take samples for preliminary study.

SAMPLES ARE then analyzed in the Allis-Chalmers laboratories . . . specific treatments suggested to prevent scale, corrosion, carryover, embrittlement, and all other feedwater ills, with provisions for changing conditions.

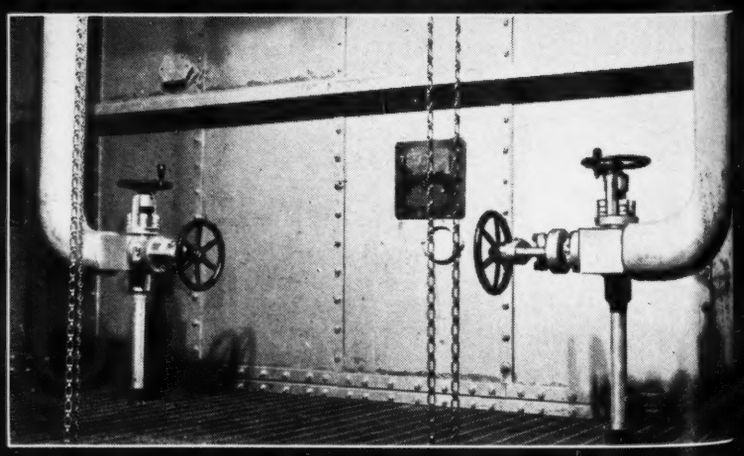
VITAL TO SUCCESS of service — the Field Service Engineer in your territory makes frequent calls . . . inspects equipment . . . makes repeated water and steam tests . . . gives you complete feedwater protection at all times.

YARWAY at

Turbine Room of the Chickasaw Station, Mobile, Alabama. New Unit of the Alabama Power Company.



Main Boiler Blow-down lines at Chickasaw Station equipped with Yarway Unit-Tandems.



Yarway Unit-Tandem Blow-Off Valves on water-wall Drains at Chickasaw.

YARWAY

Chickasaw, Ala.

900 lbs per sq. in., 900°—Chickasaw Station, Alabama, is 100% equipped with Yarway Unit-Tandems on all water-wall drains and boilers now in service.

Years of service in the highest pressure plants of leading utilities and industrials have proven the sound design and metallurgy of the Yarway Unit-Tandem for blowing-down or draining and sealing.

Such records as—"3000 blows at more than 1300 lbs per sq. in. pressure, without a single replacement of parts or repairs of any nature"—have made this Tandem the outstanding preference for high pressure service, today.

What are your draining and blow-down valve requirements? Write for Catalog B-431 for pressures up to 2500 lbs Catalog B-421 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia

BLOW-OFF VALVES

The TERRY W

TERRY
SOLID WHEEL TURBINE
ADVANTAGES . . .

— The blades and the wheel (see above) are in one piece so that there are no parts to become loose or work out.

— The blades have large clearances.

— The blades are double rim protected.

— End play will not damage the blading.

— It is impossible for the blades to foul.

— The power producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets and, therefore, close blade clearance is not necessary.

— As the only function of the blades is to form a series of pockets, wear of the blade edges is of little consequence and does not materially affect the horsepower or efficiency. The important part of the bucket is the back, or bottom, which is a solid forging.

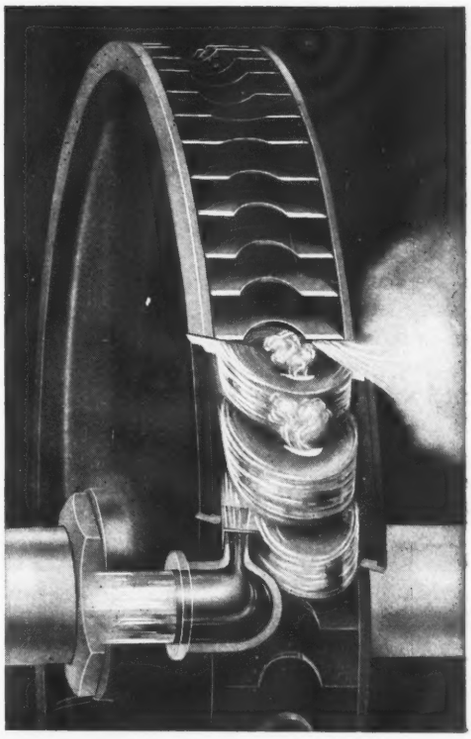
— The Terry wheel will withstand abuse that would wreck any built up wheel.

THE TERRY STEAM TURBINE CO.

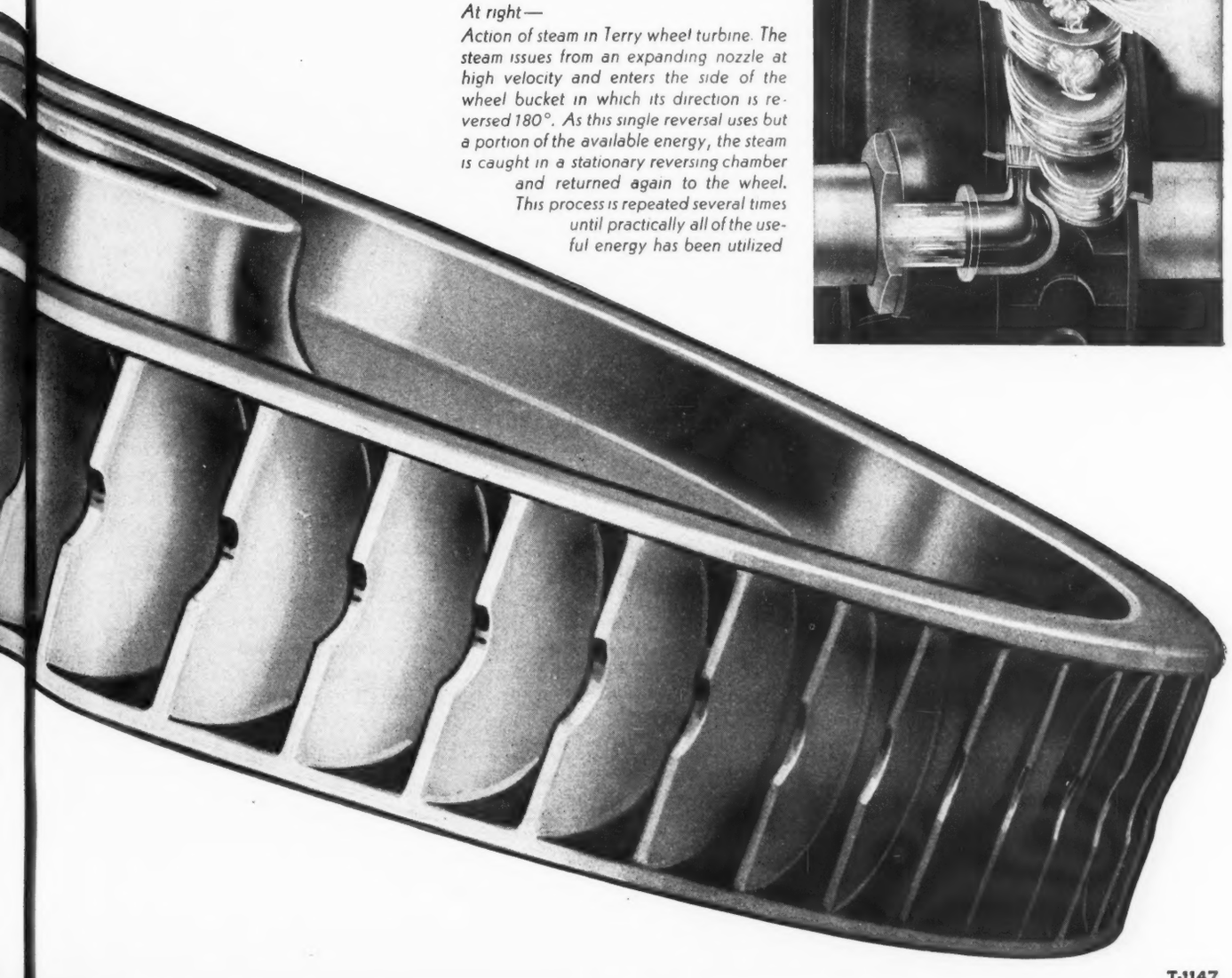
Wheel Turbine

The Terry Solid Wheel Turbine is available in ratings from 5 HP to 2000 HP. It is built for all commercial steam pressures and exhaust pressures. Thousands of them are in daily service in central stations, industrial plants and on board naval vessels.

Full details of the Terry Solid Wheel Turbine will be gladly sent upon request. Ask for Bulletin S-116.



At right—
Action of steam in Terry wheel turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket in which its direction is reversed 180°. As this single reversal uses but a portion of the available energy, the steam is caught in a stationary reversing chamber and returned again to the wheel. This process is repeated several times until practically all of the useful energy has been utilized



T-1147

TERRY SQUARE - HARTFORD, CONN.

"Phosphorized Admiralty Tubes"*

After 36 Months of Volume Commercial Application

Since 1939 when Phosphorized Admiralty Condenser Tubes were introduced, several million pounds have been installed in public utility, industrial, marine and refinery services. This three-year period of large volume commercial use has borne out the laboratory test indications that the addition of Phosphorous to admiralty metal tubes inhibits dezincification and increases service life in installations where dezincification is a corrosion factor.

The marked influence of a very small percentage of Phosphorous in controlling this form of corrosion of Brass has been the subject of considerable research. In this connection, much interest has been shown not only in the actual ability of Phosphorized Admiralty and other phosphorized brasses to inhibit dezincification but in the reasons for the beneficial effect imparted to such alloys by Phosphorous.

Several theories have been advanced and much investigational work has been carried out to explain the inhibiting action of Phosphorous in brasses under service conditions which would normally result in dezincification of the metal. This problem will be better understood by a consideration of the properties of Phosphorous and its compounds.

Phosphorous is non-metallic in character and enters into combination with Oxygen to form a series of oxides. From Phosphorous and its various oxides, a number of metal salts may be obtained. With the exception of Sodium and Potassium salts, these metal compounds are, in general, insoluble in water. In some cases, these salts exhibit colloidal properties to some degree. The end product of the oxidation of Phosphorous gives ortho-phosphates and, in the presence of sufficient Oxygen, ortho-phosphates will be found.

One interesting detail in connection with the compounds of Phosphorous is the behavior of Tin and Phosphorous when they are present in the same solution. Tin Oxide in colloidal solution readily takes up or absorbs Phosphates and this reaction usually hastens the precipitation of Tin in a very insoluble form. It was earlier believed that this reaction was entirely of a colloidal nature, but, recently, it has been shown that a definite compound of Tin Phosphate is formed, at least in certain conditions. This particular reaction between Tin and Phosphorous compounds is stressed because it has been noted in a research on the dezincification of brasses that the presence of Tin in itself retards dezincification to some extent; but the addition of Phosphorous (as in Phosphorized Admiralty metal) is necessary to prevent dezincification of the alloy.

If the foregoing discussion of the formation of insoluble and colloidal metal salts of Phosphorous is remembered, the dezincification-resistant property imparted to Brass by the addition of Phosphorous can more readily be explained. In services where dezincification of Admiralty metal or other brasses has been experienced, the phosphorous content of the dezincification-resistant alloys probably promotes the formation of a protective film (in the nature of a metal phosphate or phosphide such as Copper Phosphide Cu_3P_2), which coats the metal surface at initially corroded areas and arrests further action at such areas.

The reactions which take place in the formation of the phosphorous containing film may or may not be complex in nature, as may be anticipated from the above remarks on the chemical reactions of Phosphorous. Thus, in the early stages of corrosion, Phosphorous, together with Copper, Zinc and Tin may pass into solution and the Phosphorous may then combine with certain of the metal ions in solution to form an insoluble compound which coats the metal surface as a stable impervious film. The formation of this compound may involve nothing more than introduction of ions of the reacting elements into the solution, followed by precipitation and deposition of certain combinations of such ions on the metal surface.

It is probable, however, that a more complex series of reactions takes place and may be better explained by considering the existence

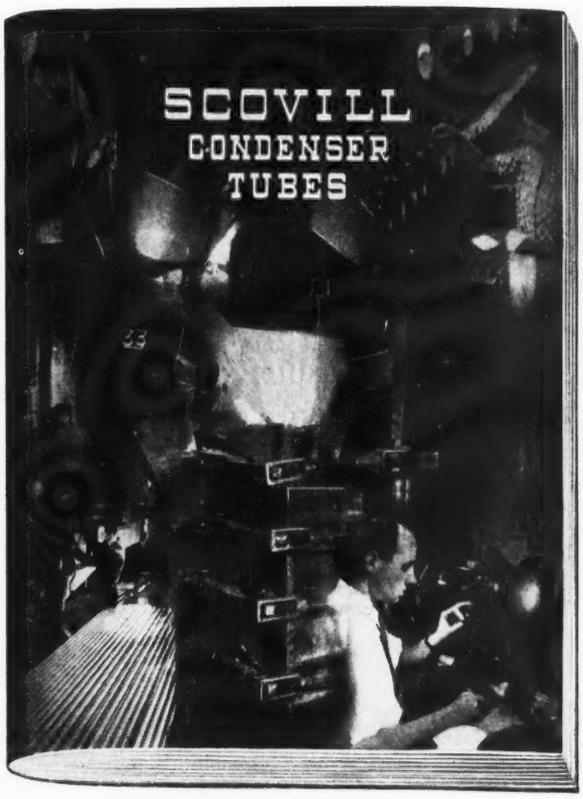
* "Phosphorized Admiralty Tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by Scovill Manufacturing Company, the owner of this patent.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL
one product . . .
SERVICE IN MANUALS . . .

of colloids in the medium in contact with the metal surface. In this connection, it may be pointed out that very minute quantities of colloids in a solution often-times produce a profound change in the behavior of such solutions. In the plating of metals, for example, colloids in the plating bath may alter the type of plate, may prevent plating altogether, or may change the conditions (current density, voltage, etc.) at which satisfactory plating may be carried out. The subject of plating is introduced in this discussion of colloids because dezincification may be looked upon as a plating operation in which Copper is plated upon the brass, usually in the form of a porous, brittle mass. In the case of Phosphorized Admiralty Tubes, colloidal Tin Phosphate or other metal phosphates may play an important part in preventing dezincification of the alloy.

Wherever dezincification of Admiralty metal tubes has been a serious corrosion problem, the use of Phosphorized Admiralty metal tubes is suggested. This alloy combines the general excellent corrosion-resistant properties of Admiralty metal, a desirable fine grain structure of the finished tubes, favorable physical properties and a very definite improvement over Admiralty metal in its very marked resistance to dezincification.



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Scovill, for many years a regular source of supply for the U. S. Government, is cooperating in every way to forward defense plans. When deliveries are not as prompt as our customers desire, we hope they will realize that delays are sometimes unavoidable, and part of the price paid for National Defense.

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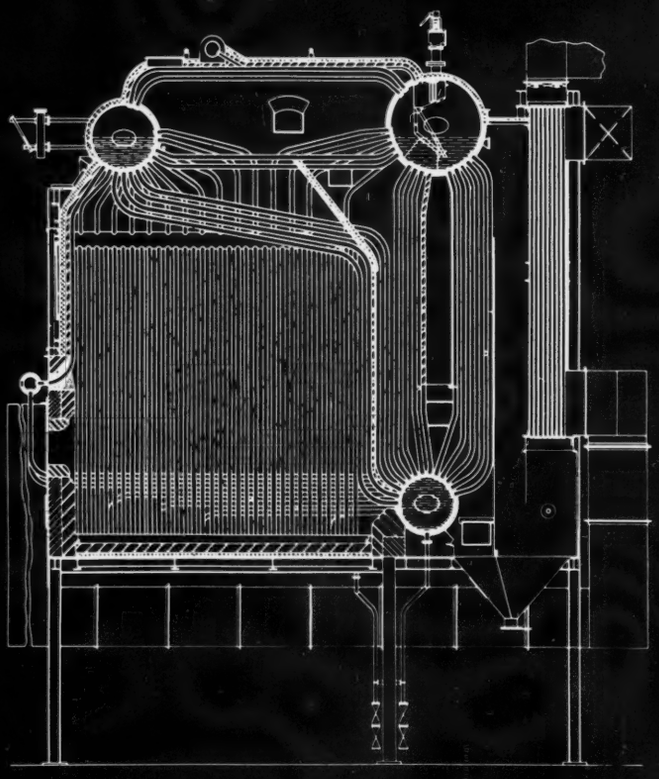
AVAILABILITY OF EXISTING DESIGNS MAKES POSSIBLE THE PROMPT REPRODUCTION OF THIS EDGE MOOR

THREE DRUM RADIANT HEAT BOILER

—installed at the Chemical & Pigment Company—



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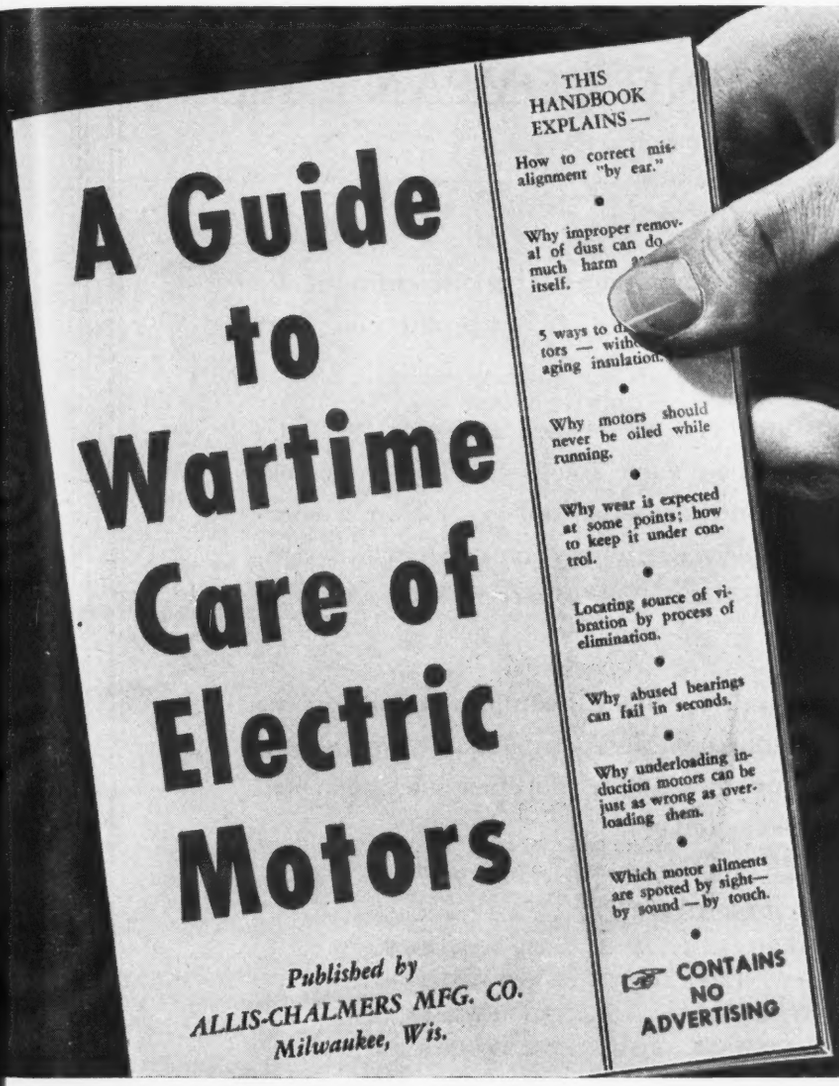
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Why motors should never be oiled while running.
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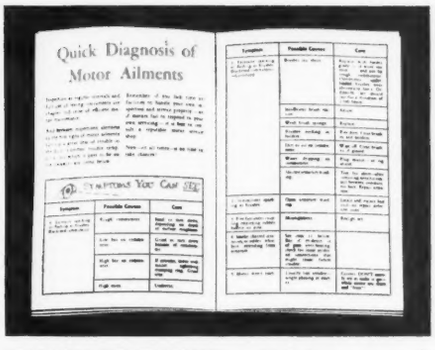

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An Announcement by

BUELL ENGINEERING COMPANY, Inc.

* * *

Buell Engineering Company, Inc. announces it is discontinuing its non-exclusive sales agency agreement with B. F. Sturtevant Company, as of August 1, 1942.

This agreement, entered into in March, 1939, authorized the B. F. Sturtevant Company to sell in their name Buell (van Tongeren) dust collectors in the continental United States and Alaska on a commission basis. Buell however has been entirely responsible for the design, construction and operation of all Buell (van Tongeren) dust collectors sold by Sturtevant.

After August 1st, 1942 all inquiries for Buell equipment and services should be directed to Buell Engineering Company, Inc., 70 Pine Street, New York City, or to the company's own established sales representatives located in principal cities as follows:

Atlanta, Ga.—MOORE-BROACH ENGINEERING CO.....412 Title Building
Buffalo, N. Y.—HENRY F. SPROULL.....319 Jackson Building
Chicago, Ill.—D. H. SKEEN & COMPANY.....1 La Salle Street
Dallas, Texas—A. M. LOCKETT & CO., LTD.....305 Magnolia Building
Detroit, Michigan—THE POE COMPANY.....2842 West Grand Blvd.
Houston, Texas—A. M. LOCKETT & CO., LTD.....1014 Electric Building
Milwaukee, Wisc.—THE DORNER COMPANY....2766 North Downer Avenue
New Orleans, La.—A. M. LOCKETT & CO., LTD.....308 Whitney Building
Philadelphia, Pa.—WM. P. MACKENZIE.....1211 Commercial Trust Building
Pittsburgh, Pa.—D. D. PENDLETON.....418 Bessemer Building
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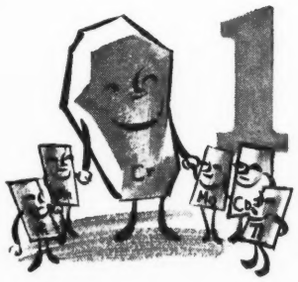
buell
DUST RECOVERY SYSTEMS

BUELL ENGINEERING COMPANY, Inc. • *70 Pine Street, New York*

Basic Facts about

STAINLESS STEELS

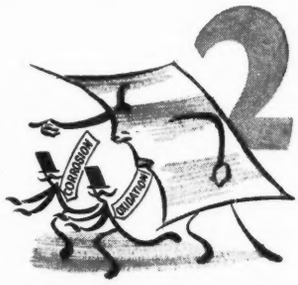
A STAINLESS STEEL PRIMER



STAINLESS STEELS

are corrosion-resistant steels containing at least 12 per cent chromium with or without other alloying elements, such as nickel, manganese, molybdenum, columbium or titanium. They are supplied in a wide range of analyses.

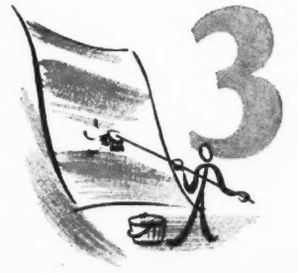
The stainless steels vary in corrosion resistance, workability, wear resistance, and physical properties according to the amount of chromium, carbon and other modifying elements present.



VALUABLE PROPERTIES INCLUDE:

Good corrosion and oxidation resistance . . . varying almost in direct proportion to the amount of chromium present.

High strength-weight ratio in some cold-rolled types permitting fabrication of strong, light-weight trains, aircraft, and other structures.

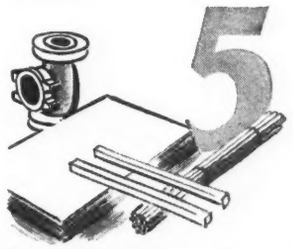


MAINTENANCE

of stainless steels is simple. Washing with soap, household cleanser, and water will keep the surface bright and free from surface deposits.

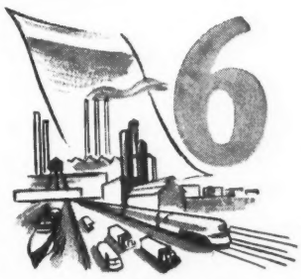
FABRICATION

is accomplished by almost all common methods. They can be machined, spun, deep-drawn, forged, punched, stamped, and otherwise mechanically-worked. They can be welded by all the common welding methods. If the austenitic steels are stabilized with columbium or titanium, and columbium-bearing welding rod is used, no annealing is necessary after welding.



MANY FORMS

are available in the common analyses including sheet, plate, strip, tubing — both seamless and welded — bars, wire, cable, welding rod, and a variety of cold-rolled shapes. Stainless steel is also supplied as foundry castings.



APPLICATIONS

of stainless steel are numerous. Because of their resistance to corrosion and oxidation, as well as their high strength and bright surface, stainless steels have been used in hospitals, chemical plants, oil refineries, railroad trains, aviation equipment, and power plants. In the present emergency, they are available only for those industries participating in war production.

• • •

Although we do not make steel, we have for more than 35 years produced "Electromet" ferro-alloys and metals used in making steel. With the knowledge accumulated from this experience, we are in a position to give impartial advice. If you have a specific problem concerning the manufacture, fabrication, or use of stainless or other alloy steels, consult us without obligation.

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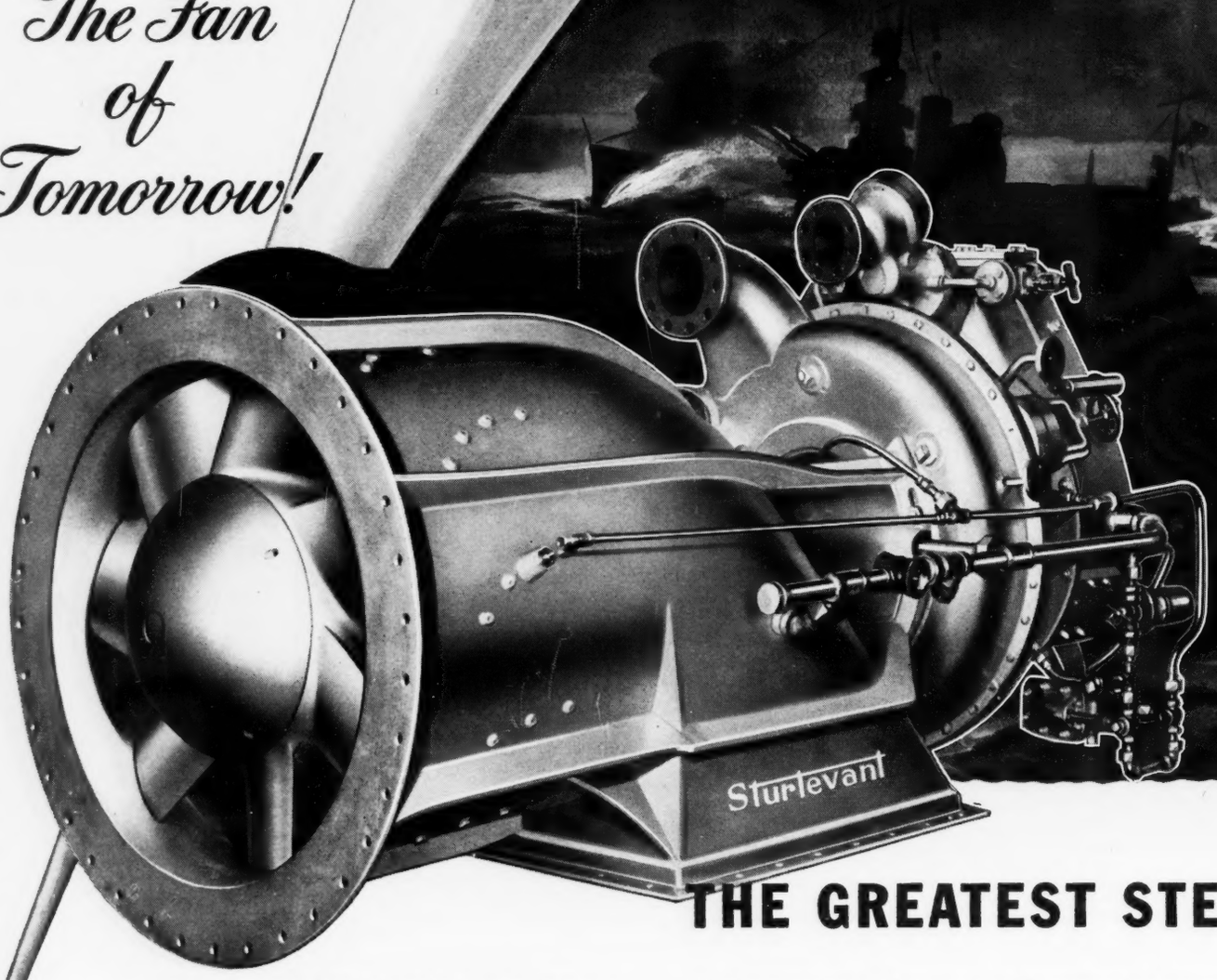

THE GREATEST STEP

NEW STURTEVANT

Victory AXIFLO Fan!

FOR NAVY FORCED DRAFT

☆

SAVES SPACE...WEIGHT...POWER

It's the greatest achievement of Sturtevant's 80 years of Fan Research...an Axiflo Fan that hits a new high in fan efficiency, in power savings, and in axial flow fan operating pressures.

TODAY—the *Victory* Axiflo Fan is saving weight, space and power aboard battleships, cruisers—in fact, every type of naval vessel—providing greater fuel and ammunition carrying capacity. The needs of our nation's Navy must be met first, and for the duration the new fan will be restricted to Naval use.

TOMORROW—when intensified competition returns,

STURTEVANT — FOUNDER OF

EFFICIENCY OVER 90%—The characteristic constant speed curve of this Fan shows mechanical efficiencies in excess of 90% available over 22% of the performance range—in excess of 75% over 70% of the performance range.

40% SAVING IN SPACE—As shown by the design of this Fan for hull ventilation—at left—it is extremely compact for the volume of air handled—generally occupying only 60% of the space required for other fan designs of comparable capacities.

BIGGER "BONES" IN THEIR TEETH!

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making every saving an important factor in successful operation, the new Axiflo Fan will be available to all industry—to bring new economies to heating, ventilating, air conditioning, mechanical draft and practically every industrial application where fans are used. Learn about this remarkable new fan development in Bulletin No. 460 describing and illustrating its various designs, construction features and performance advantages. A copy will be gladly sent on request.

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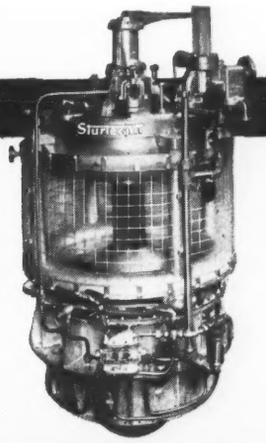
UNIFORM DUCT VELOCITIES—Ingenious STREAMVANES behind the wheel on the discharge end straighten out the tornado-like spin that comes from the wheel, insure uniform velocity and flow through the duct, higher system efficiency, less overall resistance.

STATIC PRESSURES UP TO 60″—With turbine drive, static pressures up to 60″ and speeds up to 5,000 r.p.m. are attained. Motor-driven units permit use of high speed standard motors (1160, 1750 and 3450 r.p.m.), resulting in a light, efficient driving mechanism. Quiet operation has been achieved by the elimination of turbulence. Shown at the right is a compact, turbine-driven unit of larger capacity which is designed for vertical installation.



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Regardless of whether it is in your own plant, producing war materials, or on the machine you are building to turn out war materials, slip and waste in the transmission of power will cut down production. Morse representatives offer a vital service in helping you to prevent or eliminate these handicaps and thus boost production. Thoroughly trained in power transmission problems, they are able quickly to analyze, plan, or suggest installations of new drives or improvement of old drives. Let this vital service help you.

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The world is witnessing a production miracle! American Industry and American Labor are *getting done* the greatest production job in history.

The tools of war are on the way — *and we mean on the way to battle!* Tanks from Detroit no exception!

In the making of tanks, certain vital parts are furnished by Clarage. And not only are we meeting every delivery promise — we're doing better. *Some shipments as much as five weeks ahead of schedule.*

For those engaged in war work, we are striving to maintain an exceptional service. If you need fans, blowers, or other types of air handling units, and your needs are vital — it will pay you to consult with Clarage.

COMPLETE AIR CONDITIONING
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VENTILATION
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FACTORY HEATING
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FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY—KALAMAZOO, MICH.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

how to make your ..with less outage and lower maintenance

If yours is one of the many plants operating chain grate or traveling grate stokers, here are some suggestions that will help you get longer life out of your present equipment and minimize outage for repairs or replacements. While they relate primarily to the two basic types of C-E stokers illustrated here, they are largely applicable to all chain and traveling grate stokers.

FOR PLANTS USING CHAIN AND TRAVELING GRATE STOKERS

If this information is not of immediate interest to you, please see that it reaches the proper man in your organization.

OPERATION

GENERAL The two main causes of excessive outage and maintenance are **(1)** sustained or frequent overloading of stoker and **(2)** operating with insufficient draft resulting in positive furnace pressure.

Where prolonged overloading is unavoidable, as is often the case in these days, good operation and careful attention to maintenance are especially important. Frequently, in such cases, the use of a higher quality coal will make it possible to carry the increased load without excessive outage or maintenance costs.

Where difficulties are due to insufficient draft, the suggestions made under the heading "Draft" may prove helpful.

FIRE (1) Determine by experimental operation the correct fuel bed thickness, grate speed and compartment air pressures for specific conditions of coal, capacity and furnace setting. Readjust promptly whenever a different fuel is supplied to the stoker. In general, fuel bed should be relatively thin; grate speed relatively fast. Some margin of grate speed should always be reserved for emergency condition.

(2) Keep an even fuel bed thickness across the full width of the stoker. An uneven feed or fuel bed upsets air distribution, causes fuel bed to burn out unevenly, permits overheating of sections of the grate surface and usually results in high ash pit losses.

(3) Where a low-set waterback is used at the rear of stoker, do not permit fuel to pile up at that point. Serious overheating of grate beneath may result.

(4) Keep an ample supply of coal in hopper—not less than half full – at all times during operation. Avoid segregation of coal sizes in hopper. Wherever possible use mechanically-operated swinging spout, traveling larry or non-segregating spreader chutes.

(5) Do not permit too much ash to accumulate in ash pit. Hot ashes close to rear of stoker may cause warping of grate surface and rear shaft. Keep ash pit doors tight. Serious air leakage to furnace may occur at this point, causing an increase in the preventable fuel loss.

(6) Serious damage may result from improper procedure in banking a stoker. Type of stoker, design of furnace and character of coal determine the proper method of procedure. Because of these variables, the space available here does not permit detailed instructions. However, it is a good general rule never to bank a hot fire—always burn down first. Information on proper banking procedure will be supplied by the stoker manufacturer on request.

DRAFT (1) Operate with slight draft just above fuel bed. Plus pressure will cause excessive temperatures at grates and lower wall areas.

(2) Maintain proper supply of air at all times. Either too much air or too little air will reduce efficiency and capacity.

(3) Some air should be allowed to pass through grates at all times except when fire is banked.

(4) Don't force stoker beyond capacity of stack to carry away gases.

(5) See that stoker dampers and their operating mechanisms function properly. Check air seals occasionally to be

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

COMBUSTION

stokers last longer

sure there is no leakage.

(6) If boiler draft is insufficient, check setting and flue for leaks; also position and operation of boiler damper. Some improvement is usually possible.

CLEANING (1) Remove siftings from air and sifting compartments *regularly* to avoid any possibility of fire under grate. Where steam ejectors are used, drain lines frequently to assure dry steam.

(2) Keep stoker exterior clean to prevent contamination of lubricants and excessive wear on moving parts.

INSPECTION & MAINTENANCE

(1) Inspect all accessible parts of stoker daily, and examine stoker completely when shut down—at least twice yearly.

(2) Replace broken grate elements promptly to prevent excessive sifting loss. Allow clearance between grate elements when assembling to avoid damage due to their natural growth under heat.

(3) Operation with distorted grate bars or rods may cause extensive damage.

(4) Badly worn grate bar ends and driving chains, burned ledge plates, or the combination of these conditions, can cause excessive air leakage along the grate line. The resulting "blow-torch" action is very destructive to parts in this area.

(5) Check wear on chains and sprockets frequently. Reversing them when badly worn prolongs their useful life. Proper chain tension should be maintained by adjusting "take-up" regularly. See that chains engage sprockets correctly and advance evenly to avoid rapid wear.

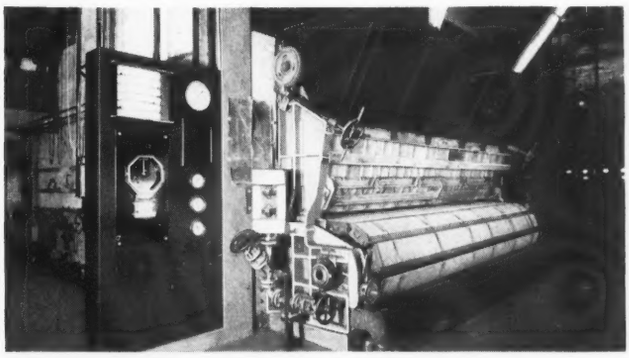
(6) Check gate tile and their supports regularly. Replace promptly when burned or warped to assure even fuel bed thickness.

(7) Inspect drive mechanism occasionally for wear on gears, condition of bearings, alignment and lubrication.

(8) Check alignment of shear coupling occasionally to be sure that it functions properly. Never use makeshift shear pins. If standard shear pins fail, determine cause of overload.

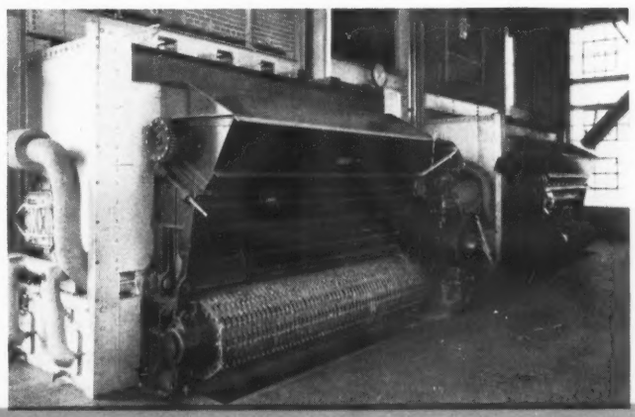
(9) Inspect return rails when possible. Replace badly worn wearing strips promptly.

LUBRICATION Lubricate all points requiring lubrication on a definite schedule. Use the correct grade of lubricants. Give particular attention to the drive mechanism. Flush and clean gear case at least once a year. Refill to correct level with new oil of proper grade. Adequate lubrication is inexpensive insurance against outage and excessive maintenance.



C-E TRAVELING GRATE STOKER—Typical installation view of the Coxe (bar type) Stoker. Unequalled for burning the small sizes of anthracite and coke breeze; also well suited to lignite and some free-burning bituminous coals. Approximate application range is from 150 rated boiler hp up to units producing 200,000 lb or more of steam per hr.

C-E CHAIN GRATE STOKER—Installation view of forced-draft chain grates; also built in natural draft designs. Particularly well-suited to the use of free-burning bituminous coals. Approximate application range is from 150 rated boiler hp up to units producing 275,000 lb of steam or more per hr.



The C-E line of stokers is the most extensive on the market. It includes single retort, multiple retort, spreader, traveling and chain grate types.

OVER 17,000 C-E STOKERS HAVE BEEN PURCHASED TO DATE

Reprints of this advertisement on heavy paper available on request

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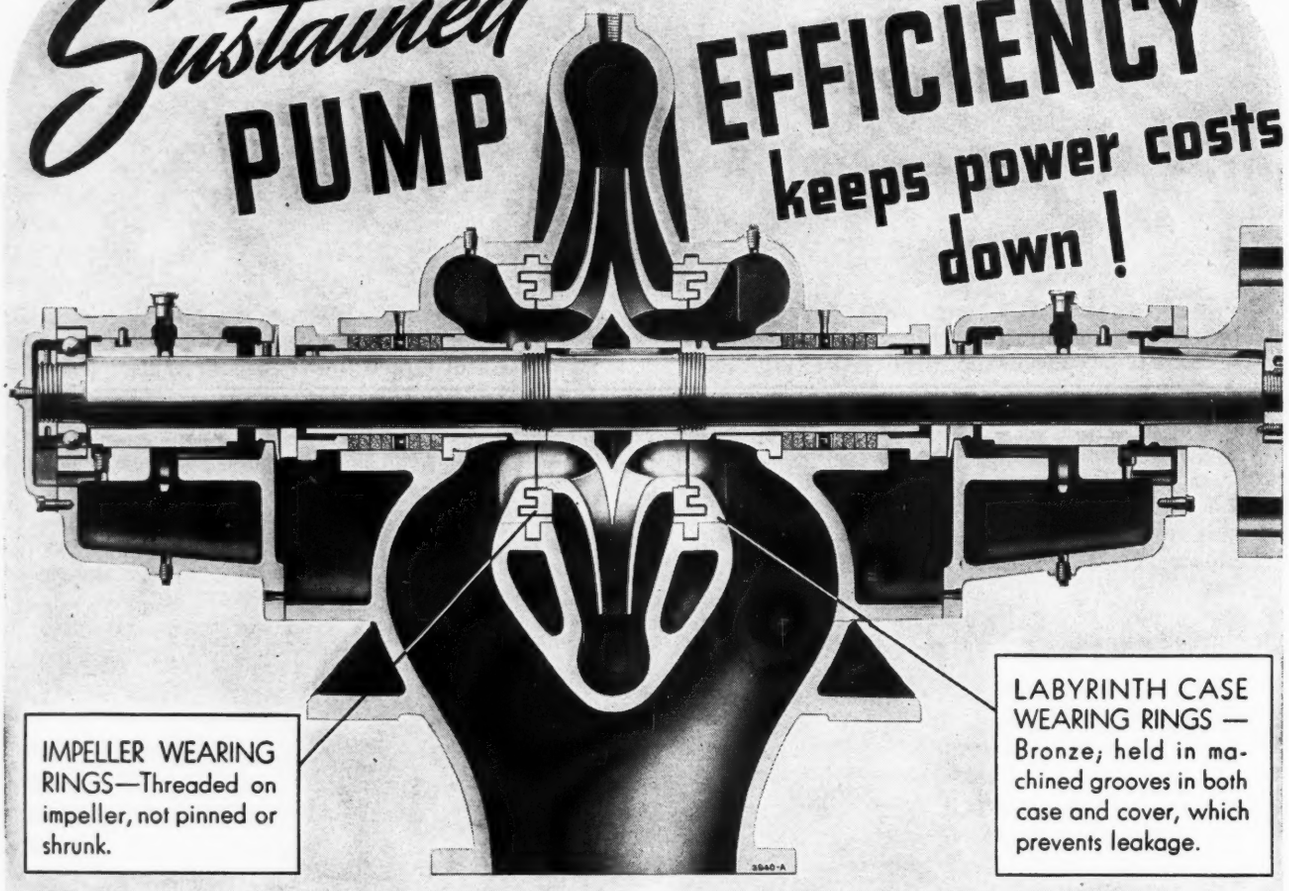
ENGINEERING

A-668

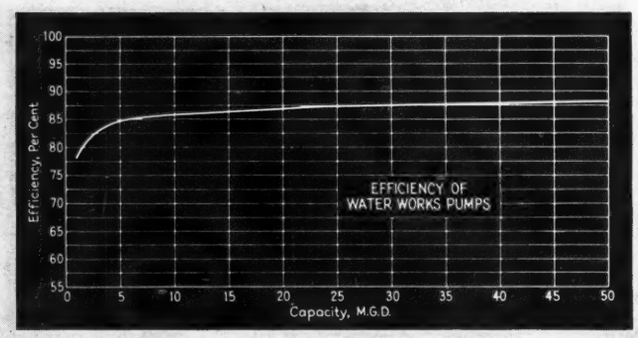
Sustained PUMP EFFICIENCY keeps power costs down!


IMPELLER WEARING RINGS—Threaded on impeller, not pinned or shrunk.
LABYRINTH CASE WEARING RINGS — Bronze; held in machined grooves in both case and cover, which prevents leakage.
3940-A

Initial high pump efficiency is sometimes obtained by the use of excessively close clearances between wearing rings, but, attained in this way, it is not long maintained, particularly where flat rings are relied upon.

DE LAVAL LABYRINTH WEARING RINGS are distinct because, without resort to close clearances, they make possible high pump efficiency, which is maintained over a long interval, as demonstrated, for instance, by two 25 m. g. d. De Laval pumps in the Shawmont Station, Philadelphia.

Unit No. 4 in the acceptance test on January 22, 1927, showed a wire-to-water efficiency of 82.7 per cent and, when tested again on January 20, 1933, an efficiency of 83.9 per cent.



Efficiencies attainable with various capacities at heads between 125 and 225 ft.

Similarly, Unit No. 5 on the acceptance test on March 3, 1927 showed 83.3 per cent efficiency and, when tested again on January 31, 1933, it showed 83.9 per cent.

•

For further particulars and other instances, ask for Publication P-3225.

DE LAVAL STEAM TURBINE CO. . . TRENTON, N. J.

VOLUME 86, No. 7

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JULY, 1942

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Chicago, 520 North Michigan Ave. — Detroit, 2-144 General Motors Bldg.
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• Ability to handle wide load swings—protection against disrupted fuel bed—ability to increase combustion rate quickly and steadily—they're all in the basic design of a Link-Grate stoker. You can see the features that add up to flexibility in fuel burning.

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J-50411

We urge you to visit Link-Grate stoker installations in actual service before you specify your next installation. Get the facts on their continuous daily operating economy—the logical basis upon which to select your fuel-burning equipment. Your Westinghouse Stoker representative will arrange a visit. In the meantime, send for Bulletin 3039 on Link-Grate Multiple Retort Stokers, or B-2196-A on the Single Retort type. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N.

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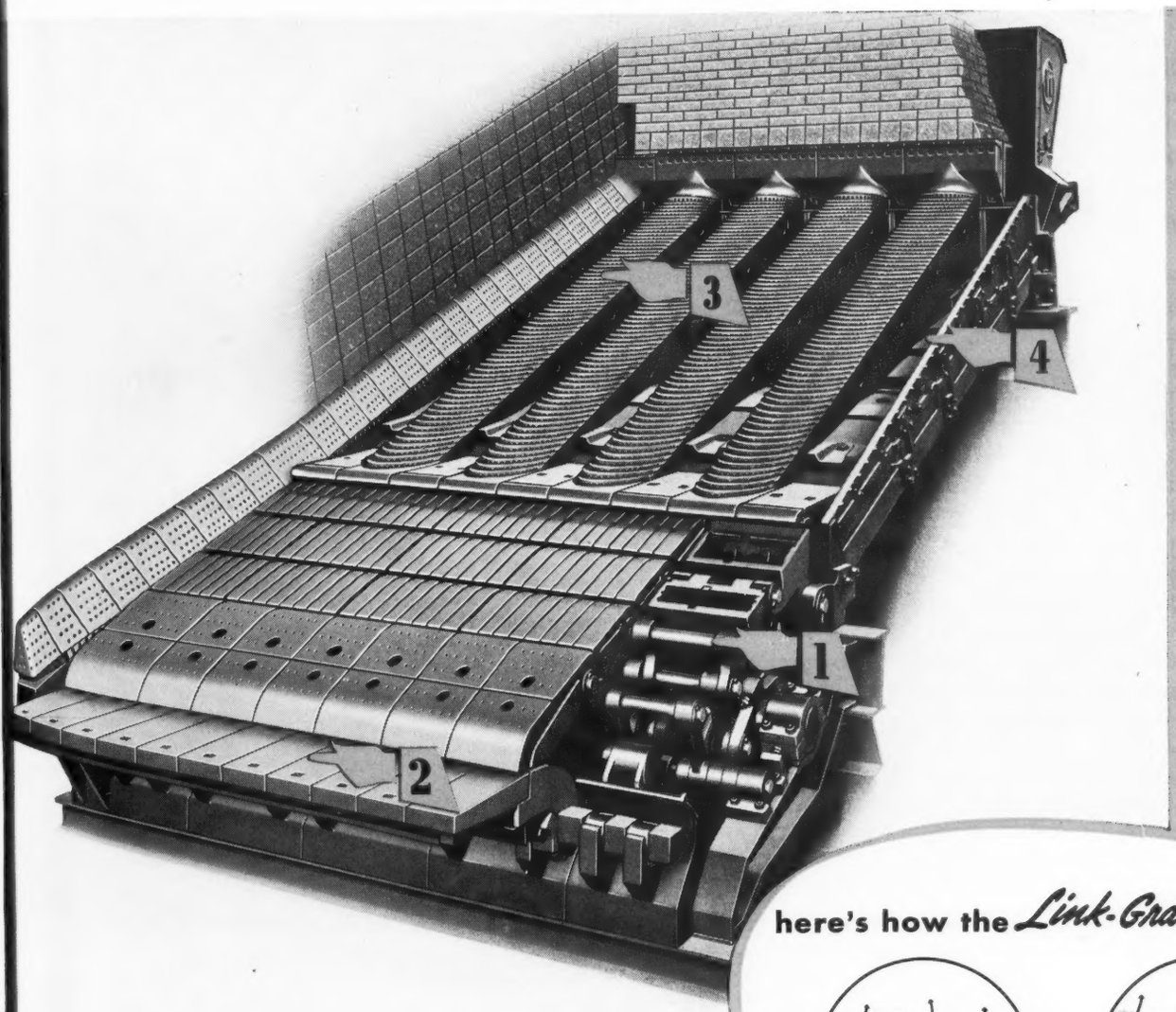
quickly...safely



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Fuel bed opened, thoroughly permeated with low pressure air admitted through grates. Fused ash oxidized, clinkers broken into small, friable pieces.

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TO "BEAT THE PROMISE" WITH PRESENT EQUIPMENT YOU'VE GOT TO BEAT CORROSION!

BYERS WROUGHT IRON

plus the

"EXPERIENCE POOL"

can help

The conversion of American Industry to war production has astounded even the most optimistic. Already authorities are saying that the era of pyramiding new industrial construction is over. Industry has sufficient tools *now* to do the job . . . if present output, based on full utilization of facilities, can be maintained.

"All-out" effort from all plant equipment allows no time-out for repairs. In both new construction and replacements, selection and installation of materials that will *last* is imperative. The Byers "Experience Pool" can help you with this job, especially as it affects plant piping.

For a number of years, practical plant men have been sharing with us their experiences with various piping materials in all kinds of corrosive services. The information has been supplemented with water analyses, general corrosion data, and analytical studies made by our laboratories. This "Experience Pool" provides overworked engineers with a practical, quick and accurate "short-cut" in pipe selection. There is no cost or red tape; just write us details, and we'll make recommendations.

Ask, too, for our latest General Catalog, which will give you complete information on pipe, casing and all other Byers products.

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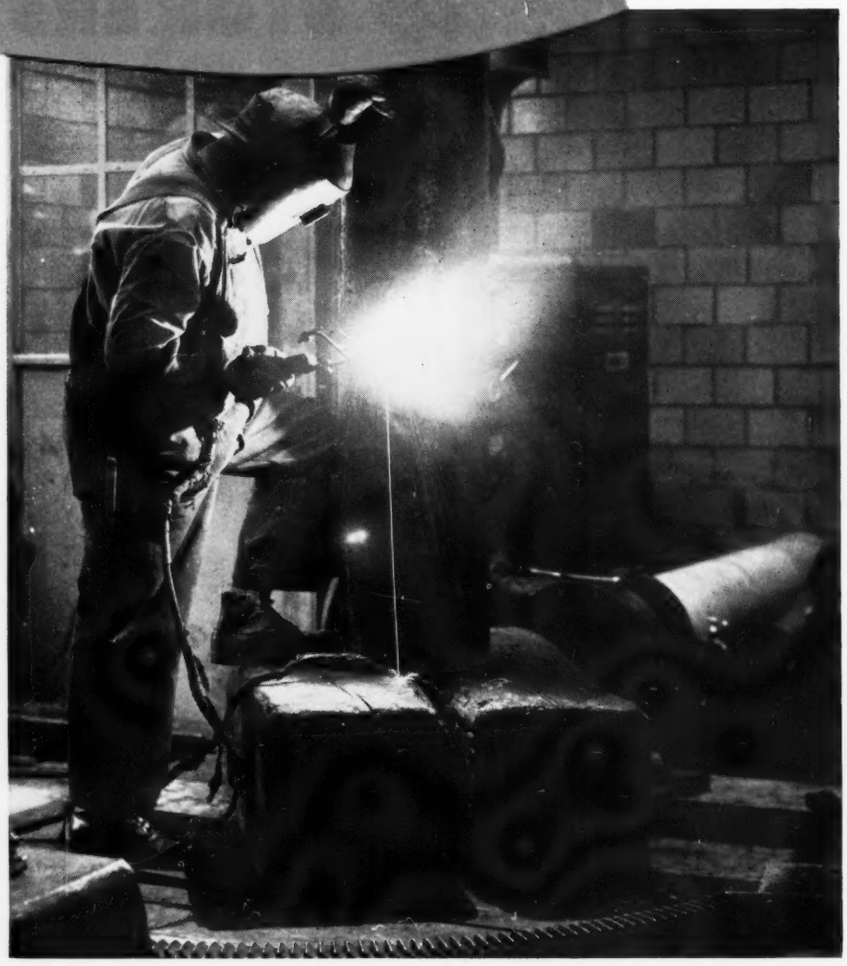
Corrosion costs you more than Wrought Iron



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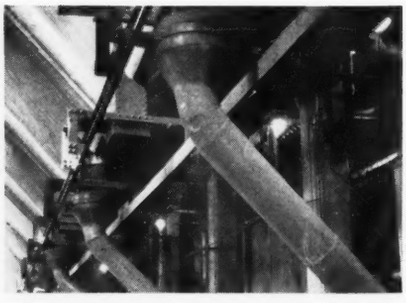

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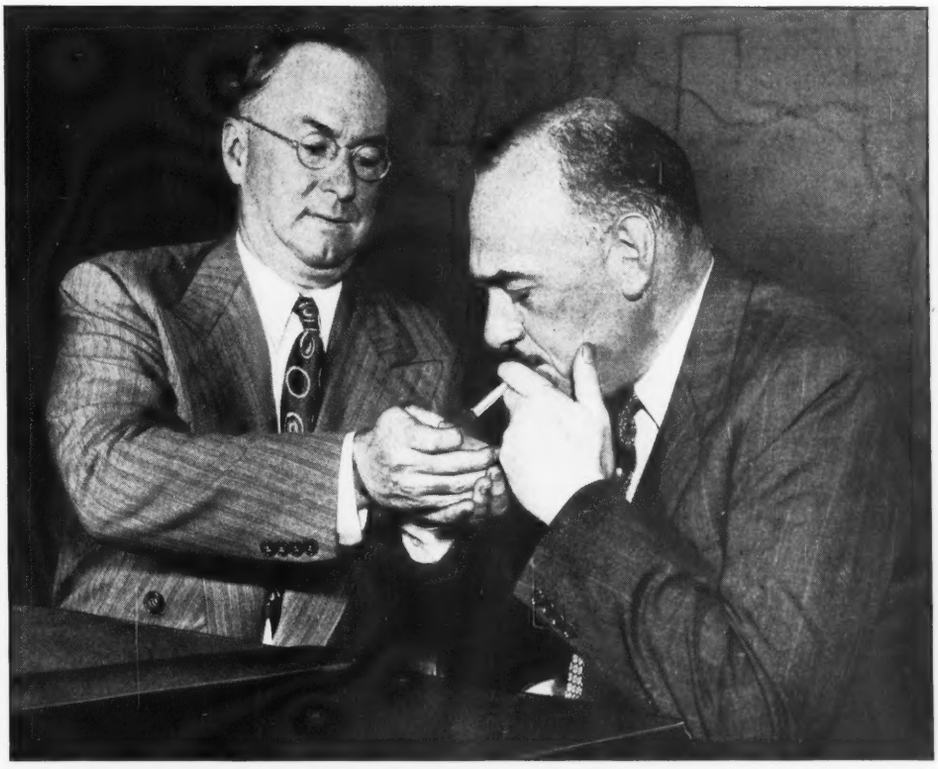
BYERS GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

STEEL TUBULAR PRODUCTS

The Story That Must Be Told



Two men who know the story best: Donald Nelson, Chief of the U. S. War Production Board, and (right) Oliver Lyttelton, Great Britain's Minister of Production.

BETWEEN THE LINES of today's war news is written a story that is even more vital than the news itself. For through that story we begin to discern the pattern of victory, not yet complete in all its details but increasingly clear in its essentials.

It is the amazing story of how American industry has responded to the call for the weapons of total war, of how its technicians, workers, and managers are driving through an unprecedented task of fantastic size and complexity.

France fell in June 1940. During that month this country produced about $150,000,000 in war goods. By June 1941 the Nazis had overrun the Balkans; and in that month our war production was $800,000,000. The fateful month of December 1941 gave us an output of $1,800,000,000—an increase better than tenfold in eighteen months. And in May 1942 our total expenditures for war equipment and supplies mounted to the staggering total of $3,500,000,000.

This is an increase of twentyfold within two years, of itself a stupendous industrial achievement. But what is even more important, that achievement already is making itself felt the world over—in the Orient, in Australia, in Libya, in Europe, in the Coral Sea, at Midway Island, at the Aleutians, and wherever else we find a battlefront manned by free men.

To accomplish it, many industries have been pouring out war materials at a rate that only six months ago did not seem even remotely possible. Starting from scratch, our factories have turned from their peacetime jobs, first to meet and then to surpass the most hopeful estimates of what might be expected of them.

To do this they have drawn heavily upon all of their resources. Their skilled and unskilled

man-power has thrown into the task a war-born will to work; their research staffs have bent to it all of their scientific resources; their engineers have applied to it their utmost ingenuity; their executives have devoted to it the full measure of that managerial skill which has won for American industry the respect of the modern world.

For the first time in history we have pushed the accelerator of the world's greatest engine of mass production down to the floorboard. Always in times of peace, factory men have had to gear production to what the markets would take. But now the market they are called upon to serve is hungry for the last ounce of potential output. For war confronts industry with a demand limited only by its capacity to produce.

During these feverish months, while a desperate world has watched breathlessly to see how American industry would perform as the arsenal of democracy, we of McGraw-Hill have followed with mounting pride — at times almost with wonder — a new miracle of industrial achievement.

Some day the full story of this American industrial effort will fill a brilliant chapter in the epic history of our times. Meanwhile it would be premature to celebrate the completion of this task. For victory has not yet been won; that still lies at the far end of a road that we may find to be long and arduous.

But even now we can be certain of one essential of that victory. American industry is doing its job; it is delivering all that the people have asked of it — and more.

As I have watched with my associates the unfolding of this picture, I have wished that it were possible to broadcast it, in full color and wealth of detail, to the people of America, so that they could understand at least, in part, the job their industry is doing for them. It would help, it seemed to me, if the men of industry themselves, each so intent on his own task, knew what their fellow-workers in other fields have been doing.

However, the managers of industry have been far too busy ***doing*** to talk. They are going to be just as busy for some time to come. Naturally, many details are yet to be spread upon the record and, indeed, the full story cannot be told. But that part of the story that can be told is well worth the telling and the hearing, if only for its revelation of the spirit of an awakened America, throwing its all into the fight against the tyranny that has brought so many of the world's little people under its heel.

The 1941 war production of the United Nations, exclusive of the United States, equalled the total 1941 war output of Germany with all of its captive plants and enslaved labor. Since Germany's 1941 operations were at maximum capacity no further increase is possible. British output has been expanding to the point where its 1942 production is considerably ahead of Germany's.

In May 1942 American war production passed the British output 50 days ahead of schedule. In 1943 it will be 3 times that of the British.

This has been brought about under the leadership of Donald Nelson and the War Production Board, the Army, the Navy, the Maritime Commission, with the cooperation of management and labor. It has been furthered by the cooperation of Oliver Lyttelton, British Minister of Production, and other British production authorities.

But the story goes far beyond that. It gives us a glimpse of the America as it will emerge from this war, its industries again setting world standards of production, which will become the spearhead of our post-war economy.

This is a story that cannot be adequately told in generalities. It must be told in some detail. For instance, the great accomplishments of the machine tool industry, the great forward strides made by the aviation industry, the tremendous achievements of the chemical industry, the amazing conversion of many industries will warm the hearts of Americans.

These aspects of the subject deserve the fullest treatment and will be told month by month in these pages until the story has been completely unfolded. We will try to give a concise overall picture of the war job that industry has done and still is doing. You will find it a thoroughly American story of high American achievement in which every American can take pride and from which every American can take hope for the future of his country.

The story is far too significant to be withheld any longer.

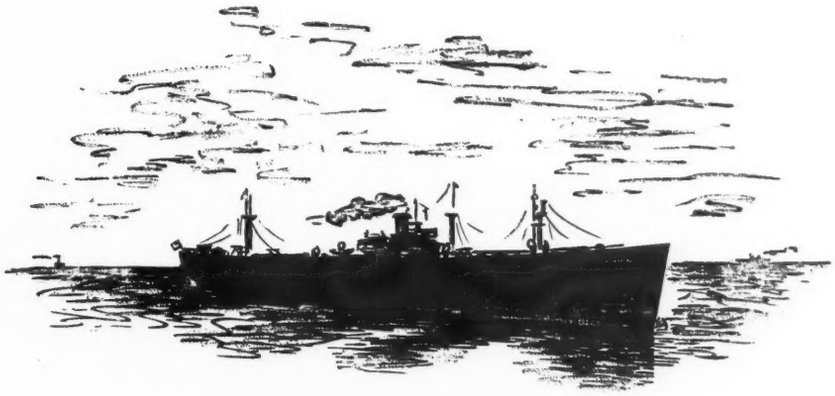
James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

POWER

Established 1882 • PHILIP W SWAIN, Editor



Back to the Sea!

Many a POWER reader learned his engineer's "trade" at sea. From New York to San Francisco ex-marine engineers are supervising plant operation in central stations, factories and skyscrapers. Their offices and plants gleam with polished brass—proof of shipshape habits. These are men with the proper respect for an engine—the regard one acquires when the nearest repair shop is thousands of miles away.

To these sea-trained power-engineers we dedicate the article "Who Will Man the Liberty Ships?" on page 64. Searching for the answer to the question in this title, the editors can't escape the conclusion that many engineers for the new Liberty ships must come from the ranks of POWER readers—first from those with a seagoing background, and second from other good power men who can quickly learn what's needed in the way of nautical lore.

How many men will it take? Figure it out for yourself. Ships (Liberty predominating) are now being launched at an average rate well above two per day, and it will reach three before long. Every ship will need a chief engineer, a first assistant, a second and a third. That means from 240 to 360 new marine engineers every month. Certainly land plants must supply a lot of them.

That's why the War Shipping Administration has established a Recruitment and Manning Division and will soon set up district offices in New York, San Francisco and New Orleans, with representatives in other leading Atlantic and Pacific ports.

Reduction gears and turbines cannot yet be produced in sufficient quantities, so Liberty ships are powered by triple-expansion engines much like those of the "good old days." Many an old salt, long on land duty, will feel right at home operating one of these engines with its associated watertube oil-fired boilers.

All specifications are conservative—200 pounds steam pressure, 26-in. vacuum, all deck auxiliaries steam driven. It's the kind of plant Kipling had in mind when he wrote, "Lord, send a man like Robbie Burns to sing the song of steam."

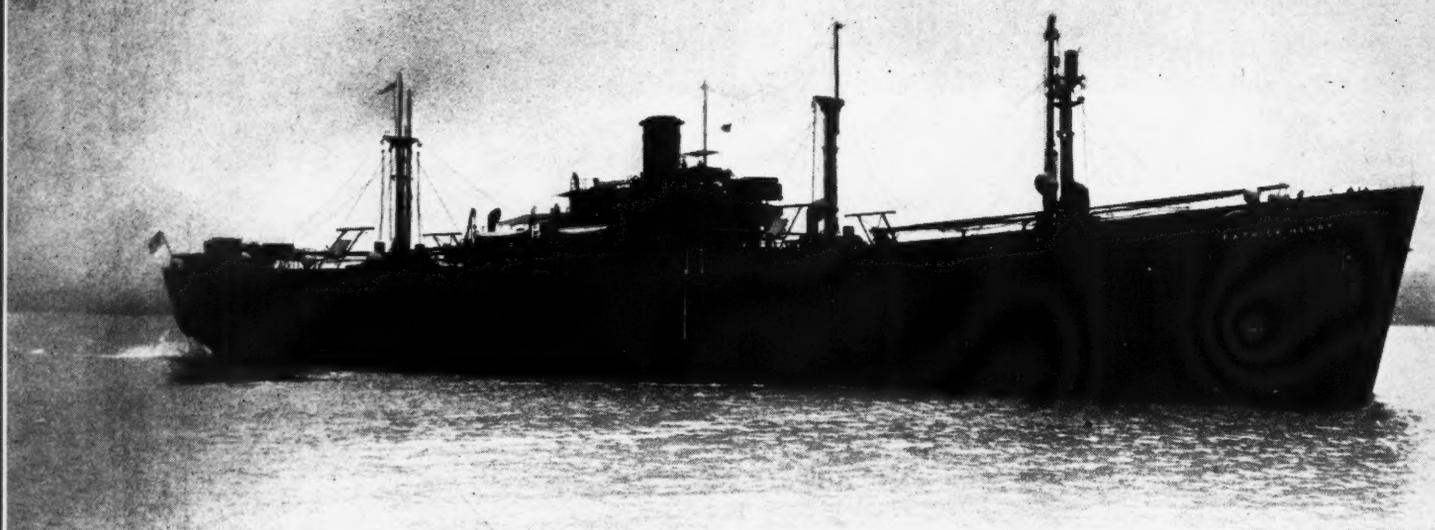
If the ex-marine engineer wants to ship again as chief his chances are good though his hair be white—and he may earn as high as $700 per month, plus keep. The lower grades, too, get special consideration. For example, an applicant for third assistant engineer can now qualify after 18 months of engine-room service on any steam or motor vessel. As little as three months at sea will "qualify" a man who has served a 3-year machinist apprenticeship on land.

The old timers who won their stripes the hard way may think all this is rushing matters a little, but what else can be done when a war's on and men *must* be found to man the ships that *must* sail?

It would not be fitting for the editors of POWER to tell any reader that he should give up his job on land to manage the power plant of some merchant ship sailing submarine-infested seas. Each man must answer that for himself after considering his personal and family situation and all other factors.

But one thing is sure; the war can't be won unless the Liberty ships sail—and they can't sail without engineers.

WHO WILL MAN THE LIBERTY SHIPS?



With shipyards delivering more than two ships a day there will be an ever increasing demand for skilled, experienced engineers now on shore duty to ferry arms and munitions to the far corners of the world in sturdy, efficient cargo ships of our merchant marine

► SHIPYARDS ARE NOW PRODUCING more than two ships a day. As each vessel leaves the fitting dock and sets out for its trial run, 40 or more men move aboard. Liberty ships, for example, carry eight officers with 36 petty officers and seamen, a total complement of 44. Simple arithmetic points out that the War Shipping Administration, charged with recruiting personnel, must tap ever greater and greater supplies of the specialized skill of men that have been to sea or have acquired equivalent shore experience.

When Uncle Sam began expanding an already huge cargo ship and tanker building program last year, the orders filled turbine, gear and diesel shops to the limit of their capacity. Turbine orders had to share power-equipment manufacturing facilities with the Navy requirements and, to a certain extent, with land turbine needs. Then the Liberty ship was born.

With reciprocating-engine drive and production-line methods, Liberty ships slide off "assembly" ways more than twice as fast as the original program of cargo and tanker vessels that once was estimated to fill the shipyards. This production rate calls for three or four times as many men to go to sea as did expectations of a year ago.

Furthermore, shipyards are beating their own schedules on Liberty ships. One was launched after five weeks on the ways as compared to five months for the best Hog Island "ugly duckling" of World War I. Another record was set by the delivery of a ship for commissioning in 46 days from the time the keel was laid. More than 1500 have been contracted for, all to be delivered by the end of 1943.

These ships are of standardized design and their equipment has been selected not to require turbines and reduction gears. No sacrifice, however, has been made in seaworthiness or efficiency except perhaps in speed. The British had already developed an emergency cargo ship; their designs were adapted to American manufacture.

According to a recent description,* the Liberty ship is a single-screw, full-scantling cargo vessel with raked stem and cruiser stern. The hull is subdivided by seven transverse bulkheads, watertight to the upper deck, providing five cargo holds. Boilers, engines, crew quarters are amidships.

Extensive use of welding has made possible the rapid production-line methods of assembly. With a displacement of 14,100 tons, gross tonnage is estimated at 7185, the length overall, 441 ft 6 in. and beam 57 ft.

Deck auxiliaries are all steam driven, including ten cargo winches spur-geared to 8x8-in. steam cylinders. A 10x12-in. steam windlass can hoist two anchors simultaneously from 30 fathoms at 30 fpm. The aft warping winch, reversible, is good for 2500-lb pull at 75 fpm with a maximum pull of 23–26,000 lb. A two-cylinder 8x8-in. steering gear engine runs condensing and is controlled by telemotor from the wheelhouse. There is also an extension to the flying bridge.

Main propulsion equipment, a direct-acting condensing 3-cylinder triple-expansion engine, turns the single screw. Steam conditions are 200 psi gage and 440 F at the throttle exhausting to a 26-in. vacuum condenser bolted to the back columns of the engine.

The 24½x48-in. cast-iron high-pressure cylinder is fitted with a high-grade cast-iron liner suitable for superheated steam. The 37-in. intermediate and 70-in. low-pressure cylinders are cast individually and bolted together. Magnesia insulation, protected by lagging, has top sections split for easy removal.

Integrally cast steam chests eliminate interconnecting piping. High-pressure

*Much of the technical data herein is condensed from Marine Engineering & Shipping Review, April, 1942.

Soup's on from the adequate galley containing a coal-burning range, steam-jacketed kettle and modern refrigeration setup

In the fitting yard the Navy provides for protection against attack by sea or by air as they supply the United Nations

A CALL TO THE SEA FOR MEN WITH THE KNOW-HOW

Our shipping link with the world overseas cannot operate unless it is steadily supplied with competent personnel. As our merchant fleet keeps growing, its manning needs steadily increase. Particularly acute needs are due to develop for engineer officers of all ranks and grades. Men who can meet the qualifications can be certain of holding permanent jobs—war-vital jobs—for the duration. They may well look forward, moreover, to serving at responsible capacities in our post-war merchant marine's task of transporting much of the world's overseas commerce.

Our government needs personnel to man its growing merchant fleet. Through the newly established Recruitment and Manning Organization, War Shipping Administration, our government is undertaking to assure adequate manning of every merchant vessel where and when needed. To accomplish this, we intend to exploit all possible resources of seafaring manpower. In recruiting engineer officers particularly, it intends:—

1. To draw back to the sea a considerable body of qualified personnel with saltwater or Great Lakes experience now working at engineer capacities in many varieties of shore employment

2. To prepare for seafaring careers as licensed officers many power plant engineers holding shore jobs who wish to qualify for the merchant marine

3. To arrange for training enough new marine engineers to meet what unsatisfied balance of manning requirements may remain after existing resources of skilled manpower are fully exploited.

When fully organized, Recruitment and Manning will operate through district offices at New York, San Francisco, and New Orleans, plus port offices at Boston, Philadelphia, Baltimore, Norfolk-Newport News, Savannah, Jacksonville, Tampa, Mobile, Galveston, Los Angeles, and Seattle.

We cannot await the full evolution of a nationwide system to start recruiting licensed engineers and other skilled seafaring personnel. Our manning needs will shortly become acute. We, therefore, urge upon all reasonably qualified engineers, who wish to serve their country in its merchant marine, that they respond to the call of the nation and the sea by registering immediately with our field representatives. To register, please get in touch with nearest port headquarters of the War Shipping Administration in New York, New Orleans, or Seattle or the U. S. Maritime Commission in any other saltwater port.

MARSHALL E DIMOCK, Director
Recruitment and Manning Organization
War Shipping Administration

piston valve as well as high and intermediate-pressure pistons have Lockwood and Carlisle rings; the low-pressure piston has a Ramsbottom ring with coach springs. Piston rods and valve stems use metallic packing. Cast-iron crosshead guides, bolted to the back column, are water cooled.

The built-up forged steel crankshaft is 14¼-in. in diameter. Piston clearances are ⅜ in. at the top and ½ in. at the bottom with the relief valves at both top and bottom of all cylinders and steam chests. Drain valves open from the bottom of each. The single-seat balanced-poppet throttle valve has a cast-steel body, Monel disk and seat ring. A pilot valve relieves pressure on the balancing piston and a butterfly, for quick throttling, is built into the extension neck between the throttle valve and high-pressure steam chest.

An 8½x7-in. reversible turning engine mounted on the after end of the bedplate operates through two sets of worm gears on the main shaft to facilitate valve setting and repairs. An air pump, two bilge pumps and an evaporator feed pump are also mounted on and driven off the main engine by linkage.

Water cooling is provided for the eccentrics, main bearings and crankpin boxes, crosshead guides and thrust blocks. A nozzle connection in the throttle valve provides lubrication for the high-pressure cylinder; another serves the piston-rod metallic packing and special leads connect to the intermediate-pressure slide valve. Tallow cocks lubricate the low-pressure slide valve and domes on the intermediate and low-pressure valve stems.

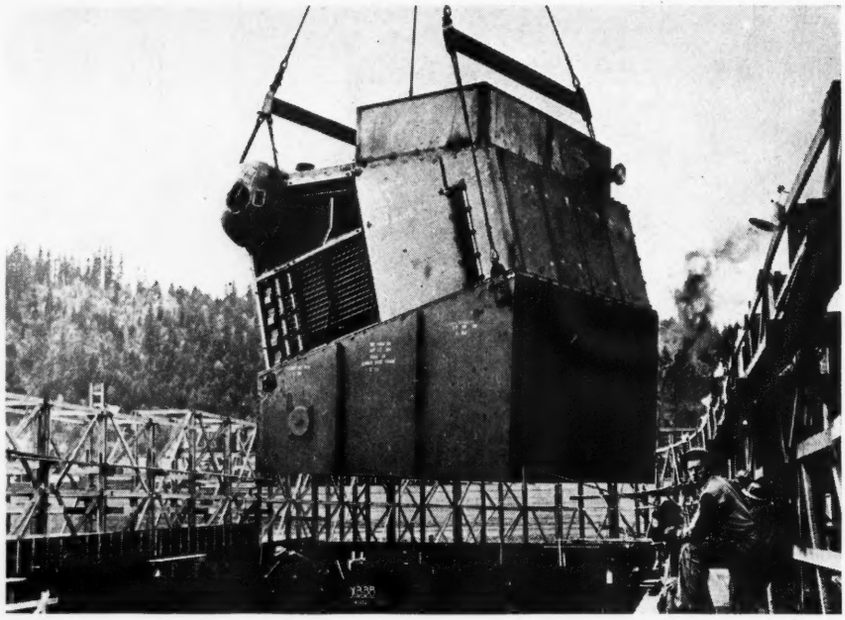
For main engine lubrication, syphon feeder wicks and pipes lead from brass oil boxes on top of the cylinders. Eccen-

trics are hand lubricated by individual cups. Main bearings are wick oiled individually. Oil boxes are also located on air-pump beam links and crosshead.

The Kingsbury thrust bearing has two 60-deg shoes for ahead and two for astern, each individually adjustable fore and aft by jackscrews. A scraper riding on the collar affords automatic lubrication of collar surfaces and journal bearings. Normally cooled by radiation, the thrust bearing has a small copper cooling coil in the oil bath for emergencies.

The 13½-in. forged-steel shaft is supported at 16-ft intervals by wick-oiled bearings with reservoirs for solidified grease. The 15¼-in. propeller shaft has a full-length composition liner carried into the recess of the propeller hub, where it is made watertight by a rubber ring.

The one-piece cast-iron stern tube, secured forward to a bulkhead and locked by a nut into the stern frame is fitted with a composition bushing lined with sectional lignum vitae staves. Service-water pipes provide emergency cooling for steady bearings and lubrication of the stern-tube bearings. The four-bladed 18-ft diameter propeller is a solid wheel with air-foil blades.



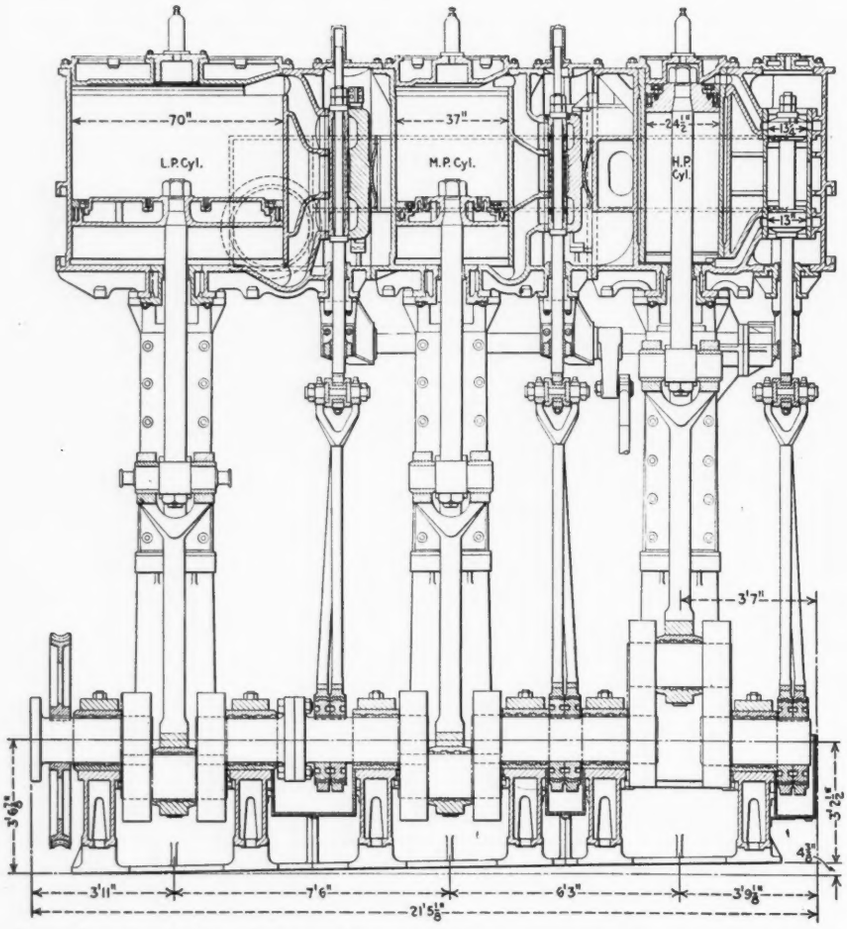
Two straight-tube oil-fired boilers of standardized design, no heat recovery, steam auxiliaries, are all familiar to land operators

A fore-and-aft firing aisle separates two oil-fired sectional-header watertube boilers, each capable of evaporating 24,000 lb per hr with 230-F feedwater. Boilers are 22-section conventional 3-pass cross-drum units with refractory furnaces. Four forced-draft oil burners use Bunker C from two fuel-oil transfer pumps. Two steam-supplied heat exchangers can each heat 3500 lb per hr of fuel oil to 230 F.

Normal boiler evaporation rate of 5 lb per hr per sq ft heating surface can be increased to 6.5 on sustained overlead. A convection superheater after the first pass is in a separate casing above the tube banks. All the steam generated passes through the superheater. No air heaters or economizers are provided but the boilers have steam soot blowers. Fuel-oil transfer pumps can handle either fuel oil or ballast water from any one tank to any other.

Feed pumps draw from feed-and-filter or reserve feed tanks and discharge to a grease extractor and open feedwater heater. The heater can be bypassed when necessary and the piping is arranged so that either feedpump can be overhauled while the other continues in service. Also, an emergency connection supplies makeup directly to the main and auxiliary condensers from the reserve tanks. Heater steam at 10 psi gage comes from the auxiliary exhausts. Drains are led to the feed-and-filter tank, which is large enough to provide storage capacity for the boiler-feed system. For washing down and emergency use, 2½-in. double-tube injector taking from the hotwell or reserve feed tank discharges to the auxiliary feed line.

A 3000-sq-ft 2-pass main condenser holds 26-in. vacuum when the engine is developing normal full power ahead. It also handles any excess auxiliary exhaust. A 2-pass auxiliary condenser of about 700 sq ft surface takes the ex-



Rugged and reliable triple-expansion condensing steam engines are being built in famous old shops all over the country. Steam conditions are 200 psi, 440 F

haust from either auxiliary generator set plus exhaust from winches and other auxiliaries during port operation. This condenser is mounted directly over a combined circulating and wet air pump.

A salt-water evaporator that can handle 4800 gpd works with a vertical distiller of 6000 gpd capacity. Steam at 125 psi is supplied to the evaporator which produces at vapor 5-psi gage for discharge to the distiller from which the condensate passes to the drinking water, and reserve-feed storage tanks.

Circulating water for the main condenser is supplied by an engine-driven centrifugal pump which also furnishes cooling water for the shaft-alley and main-engine lubrication system. An independent service pump, also steam driven, serves the distiller, refrigerating condenser, sanitary system and an emergency connection to the shaft-alley service. One of the bilge pumps is piped up for this service while at sea.

All drainage between deck spaces is controlled by the bilge systems, which take from all compartments in contact with the inner bottom. Water cannot pass from one compartment to another

Entire electric needs of the ship are supplied by two 20-kw 120-volt engine-driven generators for lighting, power and interior communication systems

or to the cargo and machinery spaces.

Only one main fire pump is provided with the general-service pump serving as standby. A clean-ballast main leads from the peak tank to the general service pump and the bilge and ballast pumps. Fresh water for drinking, wash basins, showers and baths is carried amidships in tanks above the second deck. This system is served by an automatically controlled motor-driven pump with a pressure tank and hand-pump standby. Hot water is supplied from a storage tank with heater coils amidships while a separate similar unit serves the hospital aft.

A vertical air-cooled multi-cylinder single-acting Freon compressor supplies the refrigeration for ship's stores, scuttlebutt and an ice-making tank.

Two 20-kw engine-driven generators supply 120-volt direct current for power, communication and lighting circuits. Interior-communication-system batteries are charged from this system through a separate panel. Call-bell and general alarm systems operate on a 20-volt circuit. Duplicate batteries supply the 20-volt interior communication system and separate batteries serve the radio.

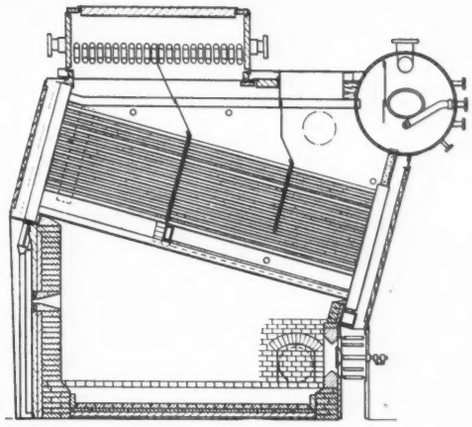
Liberty ships are built in 19 new shipyards having 171 shipways by modern mass production methods mostly by existing shipbuilding companies under the authority of the Maritime Commission. Construction and equipping are under the supervision of representatives of the Maritime Commission and each individual ship is subjected to exhaustive speed, maneuvering and endurance trials at sea under a board of naval architects and marine engineers.

A number of these ships have already entered the merchant-marine service, some having already returned from foreign ports. They are under the direction of the War Shipping Administration, which assigns them to private operators.

Insofar as possible, the expansion of officer personnel will be derived from existing sources of supply: drawing back experienced manpower from land jobs, placing in officer posts some who formerly worked in unlicensed capacities, and upgrading seamen who can meet the recently relaxed licensing requirements. So far as existing sources of manpower do not suffice, the Government will undertake to train new recruits to seafaring life, laying stress, in engineer training, on men with power plant experience at shore jobs.

In anticipation of ever increasing need for qualified personnel—deck, radio and steward as well as engineer—the War Shipping Administration is now surveying all existing and potential sources of skilled saltwater manpower. One of its major objectives is to encourage eligible engineers now in shore employment to return to, or enter, sea duty on Liberty ships and other cargo vessels, diesel motor-ships and turbine-electric-drive tankers.

Typical of the relaxed requirements* which apply for the emergency are those which apply to third assistant engineer. Applicants need only 18



3-pass cross-drum 22-section watertube boiler has small between-pass superheater section, refractory furnace, two forced-draft oil burners

months service as a qualified member of the engine department on a steam or motor vessel of any waters or, alternately, three years' experience as a machinist trade apprentice plus three months' experience at sea in the engine department of any vessel.

Similar shortening of experience requirements applies to second and first assistant engineer. A chief engineer's license can be granted by the Bureau of Marine Navigation and Inspection after only six months' experience as a first assistant engineer. Other alternates are available for men of different but equivalent experience.

Incentives include high pay in the form of temporary emergency allowances, bonuses for voyaging in dangerous waters, additional allowances for layover in foreign ports. In addition an appeal is being made to the patriotism of men with skills of definite value to the war effort of which marine-engine operation now ranks among the most valued.

Rates of pay vary among the several ship operating companies and for the different types of vessel. A fair idea of the rates, considerably higher than equivalent land wages, can be derived from a third assistant engineer's pay on a Liberty ship. He can command base pay of about $160 a month plus 15% temporary additional compensation, plus bonuses amounting to 100% or more of base pay. Chief engineers send home some $700 for each month at sea. Motorship and tanker officers command about 15% higher rates. There are also opportunities for deck engineers and pumpmen without license at about $100 a month and extras.

*Send 10c to Department of Documents, Washington, D.C. For Federal Register Reprint Series No. 52, Friday, April 10, 1942 or write Bureau of Marine Navigation and Inspection.

IMPROVED TECHNIQUES TO SPEED YOUR

Larger Electrodes and Increased Current Produce Faster Metal Deposit and Fewer Changes

H O WESTENDARP, JR,
Welding Engineer, General Electric Co

► ELECTRIC ARC WELDING has demonstrated its effectiveness in speeding up the production in large volume of goods urgently needed for the war program. As military requirements are draining manpower needed for production work, the problem now is how to produce more work with less men. Based upon present estimates of 200,000 arc-welding operators in the industry, the following data indicate that if these operators swing to larger electrodes on one-quarter of their work the result will be equivalent to an immediate addition of from 15,000 to 25,000 experienced operators in the industry. Tables 1, 2, and 3 show what increase is possible.

The answer lies in using, on those applications where work conditions permit, larger diameter electrodes which have a faster deposition rate in pounds per hour. Many jobs are being welded today with 5/32- or 3/16-in. electrodes, where rods of larger diameter could be used to produce high-quality welds at a decided increase in speed. In addition to the greater speed, which is based on the difference in deposition rates of electrodes, Fig. 1, larger electrodes reduce the number of times the operator has to stop welding and change electrodes. Time required for cleaning the crater and restriking the arc is also considerably reduced.

Using larger electrodes for increased speed is not a new idea; it has frequently been advocated by welding engineers and some progressive plants are now operating on this basis. Under today's conditions, however, it is important that this matter be investigated thoroughly by all welding users. A careful analysis should be made to determine the general classes of arc welding where this speed-up may be most effectively accomplished and the specific applications in these particular classes where work conditions permit larger electrodes to be used.

Necessary Considerations

The following considerations will serve as a guide in changing successfully from smaller to larger electrodes: A 3/16-in. electrode is the largest size with which it is practical to weld in the vertical and overhead position. Larger electrodes require amperages which produce too much heat for proper control of metal in these positions and result in spatter loss and poor welding results. An increase from 5/32-in. to 3/16-in. electrodes is not recommended for vertical fillet welds until the size of the fillet reaches 5/16 in. or greater. A 5/32-in. electrode is preferred for making 1/4-in. and smaller fillet welds in the vertical position. A 3/16-in. electrode applied to smaller fillet welds results in surplus weld metal being deposited in the form of a convex bulge on the fillet, which does not contribute to strength and wastes scarce electrode material.

Many applications are such that the work either is or can be successfully positioned for flat welding. In this, as in the vertical and overhead positions, plate thickness will affect the maximum electrode size that is practical. Generally, electrode diameters up to the plate thickness can be used. This is affected, however, by conditions, such as fit-up, and type of joints. Electrodes are available in sizes up to 3/8-in. diameter. Larger sizes have not proven practical, to date.

Study your arc-welding applications to determine ways of speeding up metal fabrication by this procedure.

Table 1

Electrode Size, in.	Electrode Changes per Lb Deposited
5/32 x 14	18
3/16 x 14	13
1/4 x 18	5
5/16 x 18	3
3/8 x 18	2

Fig. 1—These welds were produced in the same time by using a 3/16-in. electrode in the upper and a 1/4-in. electrode in the lower

Table 2—Typical Deposition Rate, Lb Per Hour—100% Arc Time

Electrode Diameter, in.	Flat	Horizontal	Vertical	Type of Electrode	
5/32	2.9	2.7	2.4	All-position Dc	Reverse Polarity
3/16	4.5	4.0	3.2	" " "	
1/4	8.0	6.0	—	Flat ac or dc	Straight Polarity
5/16	11.5	—	—	" " " "	
3/8	13.5	—	—	" " " "	" "

Magnetic arc blow increases with electrode size and welding current. The 3/8-in. electrode is recommended for ac only

Table 3

Welding Position	Change in Electrode Size, in.	Increase in Deposition Rate, %
Vertical and overhead	5/32 to 3/16	33
Horizontal	3/16 to 1/4	50
Flat	3/16 to 1/4	77
"	1/4 to 5/16	43
"	5/16 to 3/8	18

ELECTRIC-WELDING PRODUCTION

Correct Electrode Angle and Faster Electrode Travel Increase Depth of Weld Penetration

A F DAVIS,
Vice President, The Lincoln Electric Co

▶ A NEW TECHNIQUE in electric-arc fillet welding makes possible an arc speed of 65 fph for welding a $\frac{3}{8}$-in. horizontal fillet, compared with 30 fph using the conventional method. Known as the Fleet-Fillet method, it has the important advantages of faster weld production, less welding electrode per foot of weld, and lower welding costs. The basic advantage of this method lies in the fact that with properly shielded electrodes, penetration into the root of a weld increases with an increase in the speed of electrode travel, an increase of current, and the position of the electrode in relation to the work. The test specimen in Fig. 2 contains only 70% as much deposited metal, yet was found to have 15% greater strength than the usual weld.

In the conventional method the electrode is held at approximately 45 deg with the horizontal plate and at approximately 60 deg to the line of weld, with the end pointing backward. The arc is held short but travel speed is generally so slow that the electrode must be held out from the two plates to prevent dipping into the molten pool.

In the new method the average electrode position is about perpendicular to the weld line at from 45 to 60 deg with the horizontal plate, Fig. 3. The arc is so short that the coating practically touches the plates. This is not objectionable, but forcing the coating against the plates may result in a rough bead. Recommended procedure consists of maintaining correct electrode angle as shown in Fig. 3, using higher current, advancing electrode at higher speed and using electrodes recommended for this purpose. Comparisons between the conventional and Fleet-Fillet method of single-pass welding are given in Table 4.

For multi-pass welding the beads are laid from the bottom up instead of from the top down as in the usual way. This provides a flat horizontal surface for the succeeding beads, permitting higher currents and faster welding. Subsequent beads are laid with the electrode held at an angle of 70-80 deg with the horizontal plate and line of weld except for beads against the vertical plate. In this case, the electrode should be at a 45-deg angle. Allowing the slag to remain provides a dam to keep the metal from running off the edge of the preceding bead. It can then be removed after each layer of beads is completed. Fig. 4 illustrates the sequence of laying beads where the slag is removed only from the first and fourth beads.

Table 4

	Conventional	Fleet-Fillet	Fleet-Fillet
Electrode	¼"—Fleetweld 9	¼"—Fleetweld 9	¼"—Fleetweld 9
Current	300 amp dc Electrode neg	300 amp dc Electrode neg	360 amp dc Electrode neg
Arc Speed—In. per Min.	7	10	12
Size of fillet—as now defined	24/64	17/64	18/64
Apparent throat 0.707 x (size of fillet)	17/64	12/64	13/64
True or effective throat	17/64	17/64	20/64
Penetration beyond root or corner	0	5/64	8/64
Ultimate load of joint in pounds per inch of length	27,000	27,000	Plate failed at 30,000
Total cost per weld foot, in cents	13.8	9.5	8.1

Fig. 2—Fleet-Fillet technique gives increased penetration with only 70% as much deposited metal and is 15% stronger than the conventional method (see below)

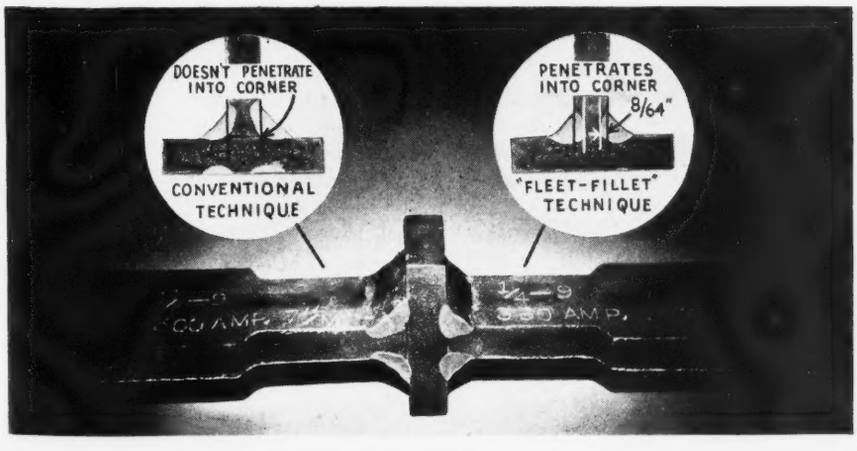
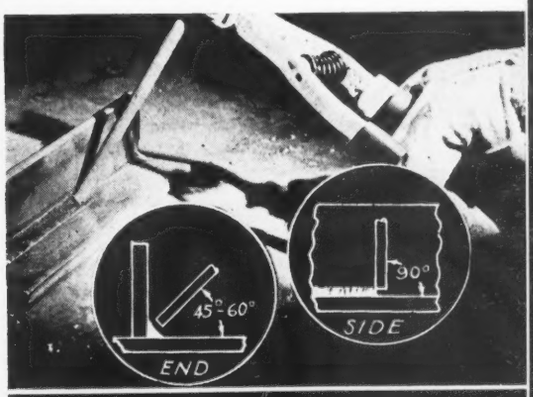
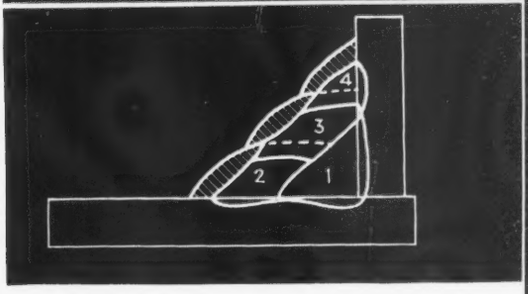
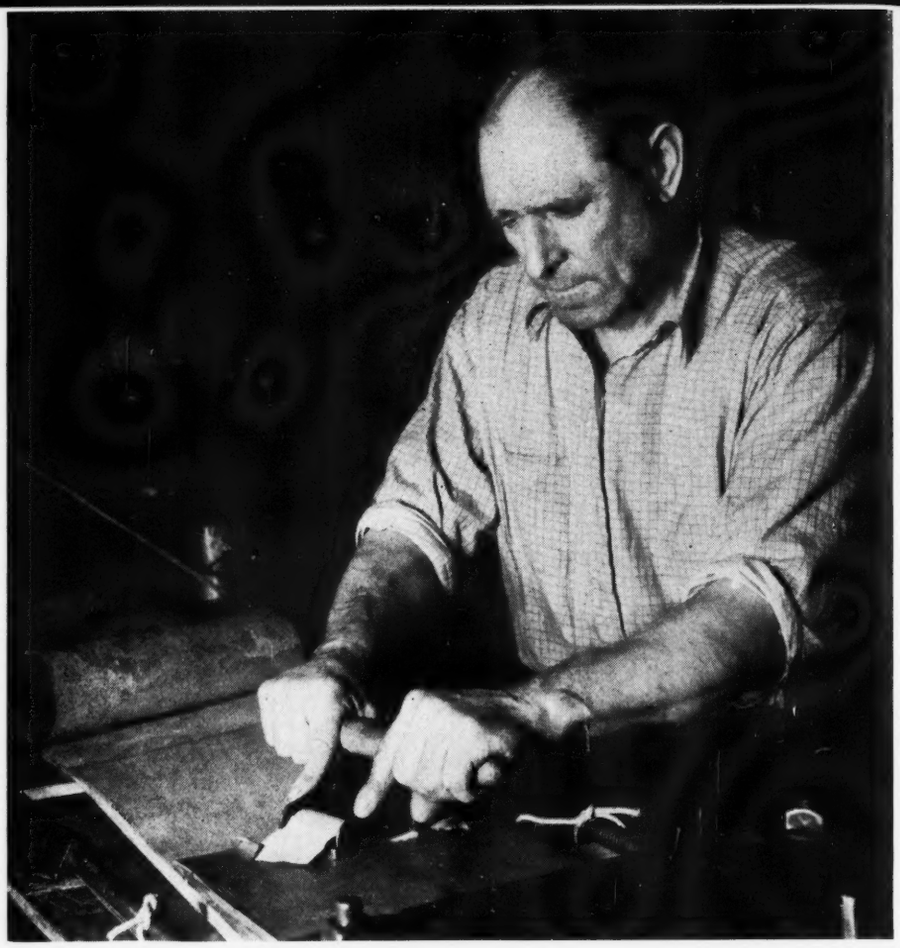


Fig. 3—Correct angle and faster travel in Fleet-Fillet method produces greater depth of penetration with less rod. Fig. 4—In multi-pass welding, beads are laid from the bottom up, just the reverse of the conventional method







Whenever possible, to obtain best results, make leather belts endless. This can be done

200 Ways to Make Leather

Before long leather may be on the "critical" list. Here are 200 suggestions for adding to the life of leather belting and

By F A ANNETT
Associate Editor

▶ LEATHER IS NOT YET on the critical list of war materials and is therefore not subject to the stringent government restrictions applying to rubber and some other materials. Already, however, certain grades of leather are not available for industrial purposes and others can be obtained only on a priority order. Many of the sources from which hides are normally obtained are closed for the duration and other large sources of supply are being seriously threatened.

Therefore every power engineer should give serious consideration, if he is not already doing so, to ways to make his mechanical leather goods last longer. Leather belting and packings are playing an important part in the war program; consequently everything possible should be done to use them intelligently. A little conservation practiced now will go a long way toward preventing a shortage later.

To help power engineers do this job, POWER editors have collected, with the assistance of Alexander Brothers, Chicago Belting Co, Graton & Knight Co, E F Houghton Co, J E Rhoads & Sons, Chas A Schieren Co and the American Leather Belting Association, and here present over 200 helpful suggestions for getting more service out of leather belting and packing. These suggestions should not be interpreted as indicating that leather products require a lot of attention, because few products will stand more abuse than leather.

How long leather products last depends largely on intelligent selection and installation and the care given them in service. Because a leather belt or packing operates month after month without complaint or outward signs of distress is no reason for neglecting it, when proper care may increase its life several times and insure a continued flow of much needed war products. In the present emergency it is the power engineer's job to produce as much as possible with as little as possible. Here's how it's done with leather belts and packings.

TRANSMISSION BELTS

▶ WHEN YOU ORDER new leather belts be sure they have ample capacity for the loads and are suited to the conditions under which they must operate. Don't forget that a little excess capacity in a belt pays big dividends in increased belt life, reliability and production output and in reduced maintenance costs.

Standardize on as few widths and plies of leather belt as will economically meet the plant requirements, to reduce the amount of spare belting that must be kept in stock.

Always operate leather belts with grain or hair side on pulleys.

Run leather belts so that the feather edge of laps on the outside points away from the pulley as the laps approach it.

Use endless belts wherever possible, made endless with a high-grade waterproof leather cement. Improper cementing may let the belt open at the endless joint.

Before cementing an old belt, remove grease from the leather by soaking its ends in a solvent, made of 25% carbon-tetrachloride and 75% gasoline, for about 30 minutes.

Be sure that a belt is properly squared and that it is lined up before making an endless splice.

Never use homemade adhesive for cementing a belt.

Always remove the tension from the lap section of a belt before making a cemented splice.

Apply belt clamps squarely to the belt and remove the tension evenly by taking a turn on each nut in order.

Before joining the end of belts with lacing or other forms of mechanical fasteners, be sure that ends are absolutely square.

Always use a steel square as a guide for the knife to make a square cut.

Don't guess at the position of the lace holes. Each hole carries a proportion of the total load and should be in correct alignment with the others.

Provide the proper space between the ends of the belt and the nearest row of fastener or lace holes.

Use the belt punch sparingly and do

easily, with simple splicing equipment when the belt is in place around its pulleys

Belts & Packings Last Longer

packing, compiled to help engineers produce more from less and so contribute another bit to the cause of final victory

not use too many or too large holes. For average conditions a No. 8, 9 or 10 punch will be found large enough.

An oval punch to cut lengthwise holes for lacing is preferable to a round punch.

Remember that material taken out of a belt to attach the fasteners is just that much deducted from its strength.

Never use a knife or other bladed instrument to punch holes in a belt, because these tools cut the belt fibers and make the holes more liable to fail and pull out.

Use proper size and type fasteners for the belts and the pulleys they run over. Using a wrong size is a common cause of pulling out.

Do not use plate or other heavy fasteners in belts that run with reverse bends or under an idler.

Renew worn fasteners before they break and damage the belt.

Inspect joints in belts periodically and repair them, by cementing with waterproof cement, at the first signs of the laps opening up at their ends.

Do not try to fix cemented joints with rivets or lacing; re-cement them.

Watch metal fasteners in belts that run on wood or paper pulleys; they may pound and damage pulley surfaces.

All belts, except those 4 in. or less in width and those operating on adjustable centers, should be joined on the pulleys by pulling them together with clamps and rods before making the joint.

Do not use a rope to run a belt on its pulleys.

Do not try to run a belt on its pulley at high speed.

Don't try to force a wide belt on its pulley or one side may be stretched more than the other and the belt will run crooked, or may be torn.

Wherever possible shorten the center distances between pulleys before attempting to run a belt on them.

Do not use undersized pulleys or they will cause fasteners to pull out or fail, plies to separate, leather to crack on the outside, and laps to open up.

Do not use belts too thick for the drive.

Use pulleys as large as conditions will permit up to sizes that will give a belt speed of 5000 fpm, as the amount of power transmitted by a belt increases approximately in direct proportion to pulley size up to this speed.

Do not operate belts at speeds above 5000 fpm if it can be avoided or without consulting the belt manufacturer.

If the belt does not run correctly on the pulleys find the cause and remove it.

Avoid excessive crowns on pulleys. They may reduce the power-transmitting capacity of the belt and produce strains along its centerline that will cause premature failure.

Do not run belts on flat-faced pulleys except on shifter drives.

Avoid thick narrow belts and excessively wide thin ones.

Use pulleys with a face ½ to 2 in. wider than the belt.

Align shafting and pulleys so that center of belt will run true on center of pulley faces.

Poor alignment causes premature belt failure and may give the belt a permanent crook or cause it to run off the pulleys.

Do not operate a belt running off one side of the pulleys; its fasteners may fail, the belt may stretch unevenly across its width and tend to run crooked.

Do not let belts run against stationary objects or they will break at the edges, causing early ply separation.

Avoid vertical drives whenever it is possible.

If vertical drives must be used, select a belt of ample capacity for the load and conditions under which it must operate.

On vertical individual-motor drives mount the motor on a pivoted base.

Avoid idlers if possible; they put a reverse bend in the belt.

If you must use an idler, use an approved unit, according to recommended practice.

If an idler must be used, apply it to the slack side of the belt whenever possible.

Do not use crowned idler pulleys because they put a reverse bend in the belt across its width, which may cause ply separation, or failure of cemented joints and fasteners.

Check idler-pulley alignment.

Avoid worn idler-pulley bearings as

they often cause belts to weave when running.

Avoid idlers that bounce off and fall back on the belt. Belts have been broken in two by this action.

Avoid idlers on short-center individual-motor drives by mounting the motor on a pivoted base. Belt tension in practice is usually determined by trial, except with a pivoted motor base, when it can be calculated.

Where possible operate belts with the slack side on top. This allows the belt to sag and increase its arc of contact with the pulleys.

Avoid shifters that do not throw the belt entirely off or on the loose pulley. Otherwise one side of the belt will be stretched more than the other and it will run crooked.

Give careful attention to belt shifters to see that they are not abusing the belt, causing its edges to curl and plies to open, or producing other effects harmful to the belts.

Use shifter with broad-surfaced sides and rounded corners as they greatly reduce edge-wear on the belt.

Keep loose-pulley bearings lubricated.

Install cross belts so that the points of the laps at the position of the cross do not run against each other and open.

Always make quarter-turn belts endless on their pulleys.

Keep belts well-aligned on flanged and stepped-cone pulleys.

Just because flanges prevent the belt from coming off flanged pulleys is no reason for neglecting to maintain good alignment and letting the belt wear itself out on the flanges.

Use the heaviest belt possible on stepped-cone and flanged pulleys, consistent with pulley diameter.

Use round-edged belts on flanged or stepped-cone pulleys.

On flanged or stepped-cone pulleys use a belt width $\frac{3}{8}$ to $\frac{1}{2}$ in. less than pulley face width.

Do not use a fillet in the corner between the flange and face of a flanged pulley. It tends to cause the side of the belt to climb the flanges.

Cut reverse fillets in the corners between the flanges and pulley face, so that the belt edge will run into it and prevent the belt from climbing the flanges.

Operate belts with the minimum tension that will prevent slipping. A properly installed, aligned and operated leather belt should run a long time before shortening is necessary.

Do not operate a belt too loosely or it will slip excessively and the frictional heat created will burn and crack the leather. A belt should not creep and slip more than 2%.

Check belt slip and creep with speed counter and pulley ratios.

Do not operate a belt too tightly or it will crack on the outside and fail prematurely, and may overheat the shaft bearings.

Never use the length of an old belt to order a new one.

When measuring belt length, use steel tape around pulleys, deduct $\frac{1}{8}$ in. per foot from this length and add length of splice.

Where excessive tension is required to prevent slipping, substituting a wood or fiber pulley for the small steel one may give relief.

Lagging the small pulley with leather, rubber or duck also permits carrying the load with reduced tension. Several plies of duck may be cemented on the pulley with good rubber cement.

On individual-motor drives, mounting the motor on a pivoted base will permit operating at reduced tension in the belt. Where such bases cannot be used, a properly selected and installed idler may solve the problem.

Recrown fiber and wood pulleys when they wear down.

Keep all obstructions away from the side of the belt to avoid rubbing if it runs off one side of the pulleys.

Don't let objects fall on or against the belt; they may cause serious harm. A heavy 12-in. double-leather belt requires a load of 16,000 lb to break it under a straight pull, but only 200-lb fouling the belt to tear it.

Clean and dress belts regularly with a good belt dressing every six months for the first year and at 3-month intervals thereafter.

Dress single-oak belts on the flesh side because the dressing penetrates more thoroughly through that side than through the grain.

When pulley surfaces begin to get glossy it is a sign that the belt needs dressing.

Prevent oil or water from dropping on a leather belt.

Where belts are subjected to frequent splashing with mineral oil that cannot be avoided, treat the belt with an oil- or waterproof dressing.

Before applying dressing clean the belt with the 25% carbon-tetrachloride, 75% gasoline solvent previously mentioned to remove excess oil.

When cleaning a belt, elbow grease applied with a scrubbing brush does a lot of good.

If oil must be removed from a belt while running, use powdered chalk; clean off the chalk after it has absorbed the oil.

Dress double-oak belts on both sides, because cement between plies resists penetration of the dressing.

Before dressing a belt, be sure it is thoroughly clean. If necessary, scrape the belt to remove the dirt.

Apply dressing with rag or brush over the entire belt surface.

Do not overdress belts; use only sufficient dressing to produce the desired results.

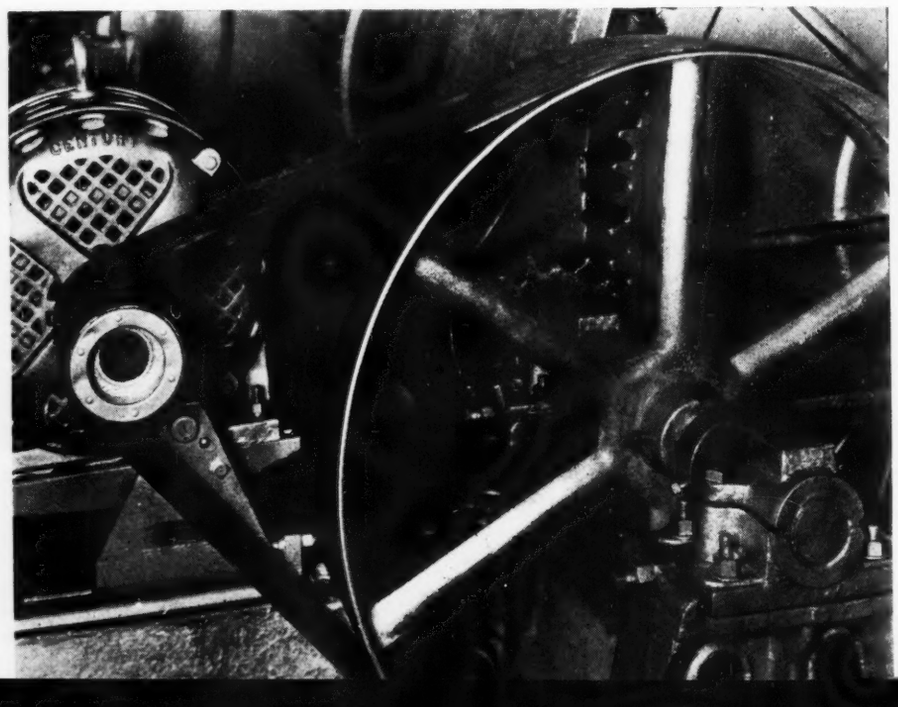
Do not use resin or other sticky belt dressings. They tend to cake and build up lumps on the belt and pulleys that subject the belt to stresses which might prove disastrous.

Keep both belt and pulleys clean.

Keep lubricating oil from the bearings or other sources from getting on leather belts.

Keep records of belt performance and study the records for causes of unsatisfactory service.

Watch for adverse operating conditions and correct them before they have



This 30 hp 865-rpm motor mounted on a reaction-torque pivoted base keeps belt tension proportional to load and makes this difficult belt application successful

time to cause excessive wear or complete belt failure.

Do not let the belt stand for a long time under tension on the pulleys.

When machines are to be shut down for a long time, remove leather belts from the pulleys. Clean off all foreign matter with a brush or scraper. Recement any laps or edges that are loose and replace worn sections. When cement is dry apply a good dressing recommended by the belt manufacturer. Apply with a brush or rag to both sides of the belt, then roll, tie and tag the belt for the drive to which it belongs.

Store all belts after treatment in a clean, cool dry place.

Two weeks before putting belts into service take them out of storage and give them an application of dressing.

Do not overload a belt and expect good service.

Do not operate belts exposed to the weather or excessive heat, if it can be avoided.

Don't operate leather belts in the presence of acid fumes or excessive moisture without first getting the manufacturer's recommendations.

Establish a schedule for belt inspection at specified intervals.

Make one man responsible for motors and shaft lubrication and for maintaining proper tension in the belts; he can then be held responsible for failures.

PACKINGS

▶ IF YOU NEED more information than given in the following suggestions check with your hydraulic-equipment or leather-packing manufacturer or get a copy of *Handbook on Hydraulic & Pneumatic Leather Packings* published by E F Houghton Co, Philadelphia, Pa.

When ordering leather packing make sure to get the right size, design and quality for the job.

When in doubt about the right kind of packing to use consult the machine manufacturer or give the packing manufacturer complete data, including accurate measurements of the packing space and associated parts of the machine, service or duty, maximum and minimum pressures, built-up pressure from zero, pressure fluid or gaseous medium to be used, speed and frequency of operation and temperature.

Don't guess at packing diameter, width, height, thickness or the dimensions of the space into which it must be installed.

Remember, small errors in packing dimensions have caused many failures.

Failure to realize that the best packing cannot withstand the severe service imposed on it by high pressures unless reasonable care is used in storing, handling, installing and maintaining it, frequently leads to unsatisfactory packing service and expensive production losses.

Use hard-leather packing for high impact pressures and a softer one for pressures built up from zero or for low impact pressures.

Make sure that the leather packing used is suited to the gas or liquid that it will contact. Many packing failures result from neglecting this rule. Common pressure fluids include water, water and soluble oil, glycerin, alcohol, alcohol and castor oil, mineral oil, vegetable oils and others. A packing treated to be suitable for one of these may not be satisfactory with another.

For oxygen service use a packing free of grease.

When oil is the pressure fluid, select a leather packing that is oil resisting or the filler may be dissolved out of the leather or completely broken down.

Avoid excessive temperatures. Vegetable-tanned leather packings are good for temperatures up to 150 F, but special heat-resisting leather packings are available that will stand temperatures up to 200 F.

See that excessive temperatures do not reach the leather packing on presses using heated platens or steam-jacketed cylinders. If these parts are not properly insulated from the plunger, temperatures at the packing may become sufficiently high to cause trouble.

Avoid excessive clearance between plungers or rams and the packing gland, otherwise the heel of U-packing, Fig. 1, page 75, will wedge in between the gland and plunger, as at *A*, and shorten its life. Either use a leather safety pad or reinforce the packing shoulder with a metal-backed follower plate to bridge the clearance between plunger and gland.

Periodically check the clearance between the plunger and gland supporting ring with feelers or inside and outside calipers. These checks should be made at several points along the plunger and inside the gland supporting ring and the cylinder to make sure of the extent of the wear and if the parts are wearing out of round. Proper clearance ranges from 0.003 in. on a 1-in. plunger to 0.012 in. for a 48-in. plunger.

You cannot expect satisfactory packing service on plungers and cylinders that are out of round; therefore, keep them in good condition.

Avoid scored cylinders, rams, pistons and piston rods, as they cut the packing and shorten its life.

Make sure that pistons, piston rods and rams run true and do not put a side thrust on the packing.

If necessary use brass sleeves in bottom of stuffing box or in packing gland to permit close clearance with the moving part and to support the packing.

Make sure that packing gland is pulled up squarely and is not cocked in a way that causes it to rub on the plunger or piston rod to score it.

Where trouble is experienced with the packing gland scoring the plunger or piston rod, bore out the gland and bush it with brass or bronze.

Have plunger or cylinder surfaces that leather packing run on machined and polished, particularly for high pressures, to increase the life of the packing.

Plungers and piston rods should be

Left—Loose operation on step-cone pulleys broke this belt and rolled its edge. Right—Slipping on the small pulley when it was too slack caused this belt to burn

made of nickel steel or other corrosion-resisting metal that will retain a polished surface.

Don't expect long service from packing on cast-iron or on scored or pitted plungers or cylinders. Resurface and polish or reline to return surfaces to good working condition.

Do not always blame leather packing for leaks. A porous casting or one with hairline surface cracks may be permitting leakage around the packing. When there are suspicions that this may be so, examine the surface of the metal with a microscope.

If not already done, slightly bevel the edge of the cylinder part through which the packing must be installed, to avoid rubbing or cutting.

Thoroughly clean the stuffing box or other recess in which the packing fits, removing grit, old packing and filler.

Use only the best-grade filler insert for U-shaped leather packing.

Cut square flax fillers for U-packing of the same width as the internal dimensions of the U, to lengths that approximate the circumference of the U, and fill the U with these up to where the bevel of the lip begins, Fig. 2, (Page 75).

Install the flax or hemp filler in U-packing to fit snugly, but not so tightly that it unduly spreads the lip of the U.

Carefully fit the joints, either bevel or butt, of the flax packing to avoid bulging after installation.

Stagger joints in the flax packing when installed in stuffing box. For two layers, joints are placed 180 deg apart and for more than two layers at least 90 deg apart.

Lubricate this packing and filler with heavy lubricating oil and graphite mixed in the proportions of one pound of graphite to one gallon of oil, or use manufacturer's recommended lubricant.

Do not install U-packing in such a way that the gland supporting ring or other parts put pressure on their lips.

Where U-packings are to replace compression packing, do not squeeze the packing, but set the gland ring where the packing is free to function as a normal mechanical packing.

Watch to see the U does not buckle or stretch excessively when inserted. If it buckles, it is too large and will wrinkle at the lip and leak eventually; if too small it will be stretched so that the lips are strained.

Don't apply packing with outside depth too great for the packing space.

Compressing U-packing or causing its lips to strike bottom will turn the lips and destroy the seal.

Don't purchase oversize packing and then drive it in place with a mallet or hammer to get a tight fit. This may damage the lip of the packing and destroy its sealing qualities.

Keep hydraulic cylinders and systems clean of sediment, as this material is very abrasive and will wear both packing and metal parts rapidly.

Watch to see that when the gland bushing is seated, the lips of leather packing are still set properly to clear the shoulder of the supporting ring, as at *A*, Fig. 2, which should be from $\frac{1}{32}$ to $\frac{1}{4}$ in.

When a metal pedestal ring is used to support the packing, as in Fig. 1, check it each time packing is replaced, looking for rough spots, buckling, or other unfavorable conditions that might distort the packing.

If pedestal rings have pressure distribution holes, make sure the holes are clear of obstructions and that the edges of the holes are not too sharp or too rounded. Sharp-edged holes cut the packing, and if they are too rounded, permit the packing to buckle and kink.

When U-packing is supported on a metal pedestal ring allow clearance between the ring and inside of the packing to permit it to swell. If sufficient clearance is not provided and the inside supporting ring is a tight fit, the packing will be forced against the side of the plunger, causing excessive friction and wear.

Be sure that the corners of the pedestal ring are slightly rounded to prevent cutting the inside shoulder of the packing.

Check glands and supporting rings for out-of-roundness or buckling and rough spots.

Replace glands when they become worn so that they permit packing to be wedged in between the gland and the moving surface.

When a worn gland cannot be replaced immediately make sure that its inner edge in contact with the packing is slightly rounded to prevent its cutting the packing, but not rounded enough not to support the packing properly.

Always watch to avoid sharp corners coming in contact with leather packing, for they scratch or cut its surface and hasten its failure.

Don't use a concave radius on the packing supporting ring of the gland. The sharp edges cut into the shoulder of the packing. Back of supporting ring should be a flat surface, as in Fig. 1.

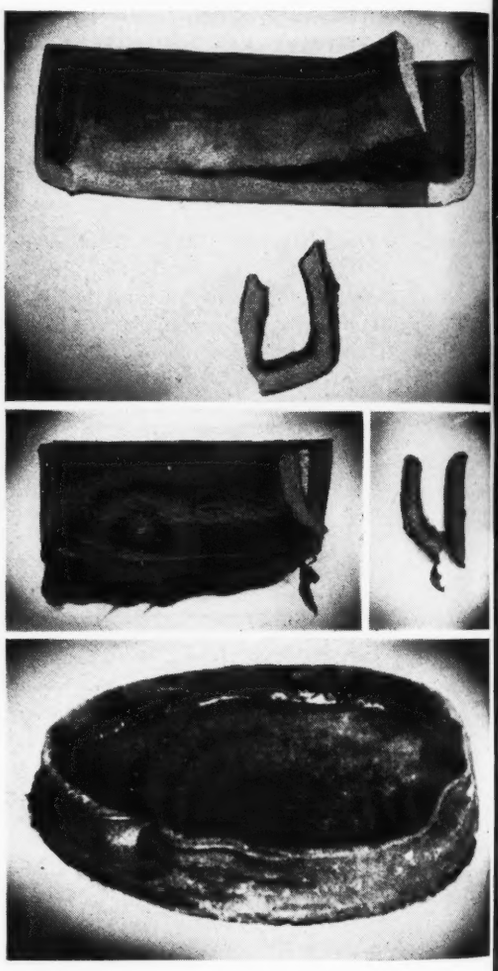
If the machine has a recessed stuffing box, Fig. 3, care must be taken when inserting the packing.

To insert the packing, Fig. 3, bend it into a heart shape, then spring it into the stuffing box. The packing must be fairly soft, but if a harder packing is used, soften it in neatsfoot oil, held at a temperature that the hand can be kept in without discomfort, for 10 or 20 minutes, depending on how soft the packing must be to meet requirements.

Take care if the softening is done in hot water, as there is danger of distorting the packing from normal shape.

Make sure that the lips or pressure edges of cup and U-packing are properly bevelled.

Don't doctor lips of packing with a knife or file or you will spoil them.



Use extreme care not to damage the working edge of packings when they are inserted.

When packing holds at high pressures and leaks at low pressure a metal expander ring may be required to hold the packing in contact with the plunger surface.

Many of the suggestions for U-packing apply equally to cup, flange and V-packings.

Select cup packings thick enough to allow a clearance equal to about one-third the thickness of the packing be-

tween the inside of the packing and the follower plate, Fig. 4.

After installation the packing swells and if sufficient clearance is not allowed around the follower plate, the packing will be forced into contact with the cylinder wall, causing excessive friction and wear.

Do not use shallow follower plates. They do not support the side walls of the cup properly and it will collapse.

Use follower plates of a thickness that extends at least up to the inside bevel of the cup.

Provide means to limit the travel of the piston so that the packing lip will not strike the bottom of the cylinder.

When a machine is not in constant use, some form of spring expander may be required to hold the lip in place and prevent the packing pulling away from the cylinder wall if it dries or shrinks.

Don't apply packing to ends of plungers if the surfaces of the plunger or cylinders are badly worn, or the pressure will force the packing into the clearance and cause it to fail in a short time.

When installing hat or flange packing, Fig. 5, be sure that it is held sufficiently tight between the gland ring and packing support to prevent leakage through the point at maximum working pressure. If the packing is too thin or too soft the gland may seat before it has properly secured the packing.

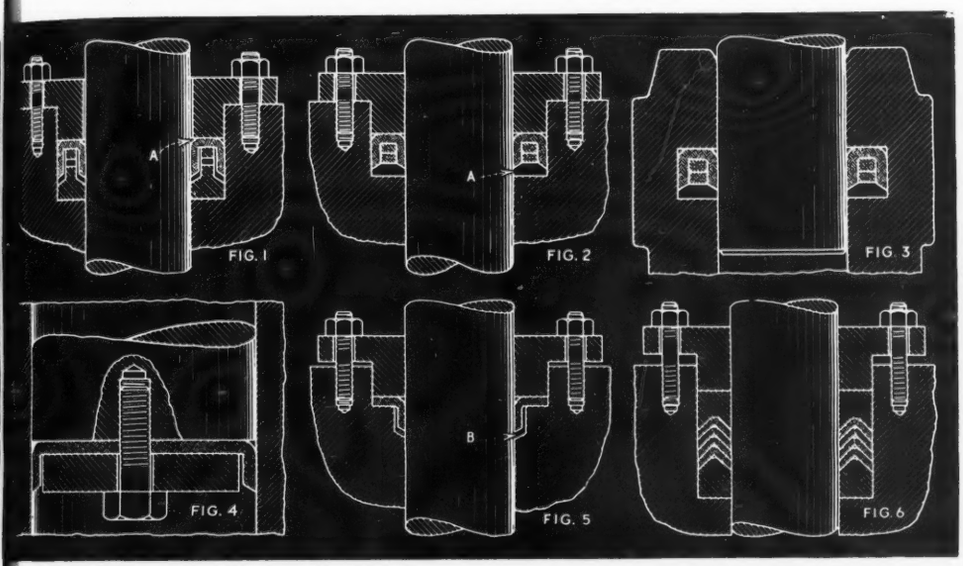


Fig. 1 — Metal supporting ring holds U-packing firmly in place. Fig. 2—Two layers of square flax packing extend to inside bevel of this U-packing to support it. Fig. 3—U-packing installed in a recess with no gland ring. Fig. 4—Cup packing mounted on the end of a plunger with follower ring extending up to top of packing lip. Fig. 5—Typical installation of flange packing with packing supported on an offset machined into the gland. Fig. 6—Typical installation of V-packing with space allowed for takeup on the gland ring

Top—Excessive clearance between ram and packing gland and a worn ram wore away the heel of the U-packing. Center—Another example of excessive clearance around packing gland, shoulder of packing extruded into the clearance. Bottom—Condition of this cup packing is caused by operating without follower plate

Make sure that the follower plate holds the packing securely in place, or it may be elongated and drawn to one side, causing short packing life.

If difficulty is experienced holding the packing with a smooth plate use a plate with two or three circular flutes on the surface in contact with the packing.

When installing cup leather packings make sure the edges do not fold back.

Keep the center section of cup leathers flat and untwisted when they are installed.

Be sure that the space in which to install the packing is large enough to permit the packing to expand without putting excessive pressure on the plunger.

Make sure that the packing space along the plunger has sufficient depth so that the bevelled lip of the packing will not strike the bottom.

Provide at least $\frac{1}{8}$ in. clearance between the packing lip and the bottom of the packing space, as at *B*, Fig. 5.

Slightly round the top inside corner of the packing space to prevent cutting the inside corner of the packing.

When applying V-packing, Fig. 6, be sure to use the correct number of packing rings of the proper thickness. This is usually between three and six.

Before installing the packing be sure that the top and bottom supporting rings are clean and in good condition.

Bring each packing ring to seat gently all around the ram before the next ring or gland is put in place.

Be careful not to fold back or otherwise injure the lips of the packing when putting it in place.

Do not draw the gland ring down too tightly or the packing will be seriously damaged.

When packing is first installed, draw down the gland finger tight and apply pressure. Release pressure and tighten gland just enough to stop leakage.

Take care to have all types of packing properly lubricated. Where water is used and then thrown away lubrication must be provided by some outside means.

On closed water systems, use soluble lubricant in the water.

Make sure that the oil-in-water combination forms a neutral solution that does not gum up or otherwise interfere with the proper operation of the system.

When oil is used as the hydraulic fluid the lubrication problem is taken care of automatically.

When possible leave leather packings in the cartons in which they were received until ready to use. These cartons are specially treated and reinforced to preserve the packing in original shape and condition.

Always store leather packing in a clean, cool, dry place.

Do not pile packing loosely in a bin or box, or hang ring packing on a nail or peg, or it will be distorted.

Do not pile one ring packing on another, because the weight of the top packings will distort the bottom ones.

Do not store cup packings loosely.

Before storing packing taken from its original wrapping, rub the packing with neatsfoot oil to preserve the leather. Pure vegetable castor oil or a mixture of cod oil and tallow are also excellent preservatives.

Where a press or other machine is to stand idle for several months remove the packing and place it in metal forms to dry. After drying, thoroughly clean, treat with neatsfoot oil and place back into the forms.

Do not remove packing from a machine for storing without putting it into forms to dry or its shape will be spoiled.

Don't expect leather packing to stand up under high pressure indefinitely if the equipment in which it is used is never inspected. It must be checked to determine if clearance between the ram and supporting ring has worn so large that the packing can slip through.

Operators Pool Experience to Solve Wartime Power Problems

Feedwater treatment, boiler cleaning, turbine deposits and overhaul schedules, discussed in round-table session at ASME semi-annual meeting

▶ POOLING THEIR EXPERIENCE, central-station and industrial power engineers and equipment manufacturers thrashed out, in an all-day round-table discussion at the ASME semi-annual meeting, the various operating problems that must be solved if wartime loads are to be met. An interesting session on overfire air for stokers and several other power papers marked the meeting, which was held June 8-10 at the Hotel Statler, Cleveland.

Under the chairmanship of R M Van Duzer, Detroit Edison Co, and with J C Hobbs, Diamond Alkali Co, as recorder, the round-table discussion was led by O F Campbell, Sinclair Refining Co; F M Welch, National Tube Co; W E Caldwell, Consolidated Edison Co of N. Y.; C H Fellows, Detroit Edison Co; E G Bailey, Babcock & Wilcox Co; B E Tate, National Cash Register Co; and G B Warren, General Electric Co. The following is a summary of the opinions expressed by the discussion leaders and the many operators and equipment engineers attending the meeting.

Boiler Availability

The discussion began in the boiler room, with a question on increasing boiler availability by shortening outage time now required for internal cleaning of boiler tubes. It was pointed out that in low-makeup plants, particularly where boiler operation is continuous for long periods, there need be no outage for turbining if feedwater treatment is successful. However, it usually proves desirable to clean boilers internally at times when the units are out for other maintenance. This gives a check on cleanliness and also removes any oxygen-concentration cells, which, if not broken, would cause progressive corrosion. More frequent cleaning may be required during the period when operators are becoming familiar with the boiler and feedwater characteristics. After successful treatment has been established, cleaning a few sample tubes may indicate that turbining can be postponed.

When boilers operate with high makeup, when banking periods are frequent, and when silica is present, feedwater treatment does not solve the problem completely, and more frequent cleaning is usually necessary. This may also apply to the hot, high-duty surfaces of low-makeup units.

Acid Cleaning

Acid cleaning of internal boiler surfaces was introduced to cut cost and reduce outage time and in some cases is the only cleaning method possible. Acid solutions are difficult to handle and extreme care is necessary for a satisfactory job. Proper inhibitors must be used and the operator must be sure that any acid remaining in boiler dead pockets is fully neutralized. It may prove desirable to use a turbine after acid cleaning, particularly where silica is present, because the acid attacks bonding agent rather than silica.

The next question tackled was "what can be done to improve cleanness of external boiler surfaces, thereby lengthening periods between shutdowns now required in most cases for hand cleaning?" While it was agreed that slagging could be reduced or even eliminated in some cases by proper coal selection, it was felt that today's conditions place a premium on ability to burn coals readily available.

Keeping upper furnace-wall surfaces clean by hand-lancing will cut down temperature at entrance to tube banks and reduce slagging in hard-to-clean areas. Finer pulverization, and more particularly, more even pulverization, with no coarse particles, will further reduce slagging difficulties in the tube banks, as will closer attention to combustion conditions, particularly excess air. Gas analyses for checking excess air must be made at the trouble point to be useful. Instead of operating modern units at full capacity to produce maximum efficiency, it may be desirable, where such continuous high-rating operation invites slagging trouble, to shift more load to older units, even if it means a loss in efficiency.

External tube corrosion, or *wasting*, presents a problem of current interest to operators of pulverized-coal units. This condition has been most prevalent in slag-tap designs. The action may be extremely slow, taking months or years to detect, or it may be quite rapid. In some cases, loss of metal from exterior tube surfaces has caused failure. It is believed that this condition can occur in dry-bottom furnaces if there is flame impingement, although with the exception of one case 10 years ago there has been little actual indication of trouble in furnaces of this design and construction.

Wasting by Corrosion

The wasting is a corrosion action rather than erosion or a sandblast effect. Although the exact mechanism is not known, it seems evident that existence of a reducing atmosphere (deficient in oxygen) in the neighborhood of the flame is the basic cause. Increasing oxygen at the furnace wall seems equivalent to eliminating impingement. Coal characteristics apparently have no bearing on whether wasting occurs or not. Iron sulfide has been found in wasted areas in some cases but there is no evidence that it contributes to the trouble.

Recent experience indicates that a definite answer to tube wasting lies in maintaining a curtain of air at the furnace wall. This may be effected by burner adjustment or by admitting air at the wall near the trouble point. Results with chrome paint and with metallizing have been inconclusive.

The relation between presence of ammonia in steam and water circuits, and deposition of copper in boiler drums and other parts received extended discussion. The amount of ammonia that can be tolerated varies widely; some report 4-6 ppm and no trouble, others report trouble with concentrations as low as 0.5 ppm. Ammonia does not affect ferrous surfaces but does attack brass and copper. Deposits of metallic copper in boilers may play some part in corrosion but

there is no evidence to show that presence of copper definitely accelerates corrosion.

In one case, a large quantity of finely divided copper was found on horizontal tubes which were badly corroded, but examination seems to indicate that galvanic action was not the cause but that the deposit caused overheating. In at least one case, use of copper gaskets in contact with steel caused corrosion and replacement with steel gaskets stopped the attack.

In another plant, a change in makeup supply built up ammonia concentration to 4 ppm and copper was found in the system, resulting apparently from a general thinning of copper and brass parts. However, no trouble could be traced to the copper. In two other central stations, copper has been found in the sludge; ammonia concentration runs high in one plant and low in the other. Several plants have found it advisable to waste inter- and aftercooler drains and vented vapors from deaerators because they run high in ammonia content.

Present conditions make it desirable to lengthen the period between turbine overhauls if possible without damage to the machine. Practice on new machines involves an inspection six months to a year after initial operation and recurring inspections at about 10,000-hour intervals (2–5 yr). On older turbines shorter intervals may prove worthwhile by giving warning of trouble and allowing time to collect materials and plan operations so that correction can be made at the next overhaul with minimum outage. On new units the first six months is critical—damage from foreign material in the piping or the unit, design defects and deposits caused by faulty feedwater treatment may be expected to show up in this period.

Watch Stage Pressures

Stage-pressure curves provided by turbine manufacturers, corrected by reference to actual conditions at initial operation, provide a useful tool for determining the need for inspection. Regular comparison of measured pressures (corrected for load, vacuum, and extraction rates) with the curves will indicate if foreign materials have caused damage or if deposits have built up. If measured pressures compare well, unit may be assumed in good condition and inspection safely postponed. Sampling difficulties limit use of temperature measurements for checking turbine condition; if it can be determined accurately, relation between steam flow and load proves a good indicator. Exhaust temperature on noncondensing units forms another useful check. Where units are provided with supervisory instruments, close attention to records will indicate development of conditions requiring inspection and possible correction.

Actual practice on inspection varies widely. Many units are inspected every year or two, while there have been cases of large machines that operated as long as ten years without inspection. Long periods between inspections may mean longer outage when overhaul takes place. The number of times a unit is started and stopped and the rate of cooling and heating have a bearing on the inspection interval; units that operate continuously are safe on a longer schedule.

Blade Deposits

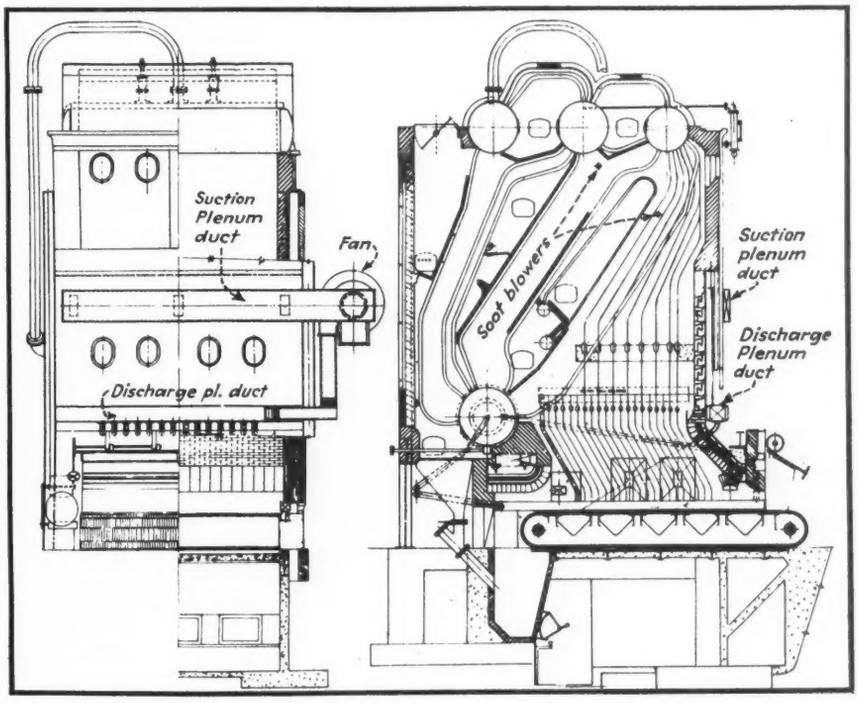
The serious effect turbine-blade deposits have on efficiency, capacity, and availability make this a major operating problem. Because millions of pounds of steam pass through a large unit each day and because a few pounds of solids will make trouble, deposits can build up from steam of relatively high purity. Soluble deposits generally build up in the initial stages and insoluble deposits in the lower middle stages. These deposits destroy the aerodynamic properties of the blades and shift stage performance, causing loss of efficiency and capacity and ultimate outage.

Soluble deposits have the same bad effects as insoluble ones, but they can be removed by shutting down and allowing the units to cool off, by dropping steam temperature, or by washing. These methods, while fairly simple, still mean either a load reduction or an outage. Frequent washing, with its temperature changes, sets up strains in the unit. Removing insoluble deposits usually means opening up the machine and blasting with flyash or other material that will not harm blade metal. Caustic and hydrofluoric acid have also been tried.

Lack of knowledge as to the way silica comes over from the boiler forms a basic difficulty. If it comes over as SiO_2, it can't be detected by conductivity methods. German research indicates that some salts may be carried over in solution, depositing in lower temperature zones of the turbine. Because amount of salts that can be carried in solution increases exponentially with temperature, this may explain the severity of the problem in high-pressure high-temperature plants.

Removal of insoluble deposits by soaking with caustic has been tried on auxiliary turbines. Sufficient softening resulted to permit removal by steam blowing. Fear of caustic embrittlement of blade roots and danger of damage caused by loosened pieces of hard scale have deterred use of caustic in steam. Although little is known regarding embrittlement possibilities, it usually requires high concentration and high stress. Thus if cleaning were carried out at low speed, without load on the machine, and the cleaning were followed by thorough rinsing, before

(*Continued on page* 140)



Overfire air increased capacity of this chain-grate unit 25% and improved efficiency 8%

THE OLD CHIEF

20–The Flu & the Flues

Another in the series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario. Writing of the inspiration of the past, he has captured much of the human side of engineering that lies beneath the maze of power plant costs and the wavy lines on paper disks

► THERE IS ONE YEAR in my long association with the Old Chief that I will never forget, and that was the year the dreaded Spanish influenza came along and wrote a human-interest story in the unkept records in 90% of the plants in this country.

Stationary engineers seemed to be particularly hard hit, perhaps because of the long hours they worked, or it may have been the inevitable drafts and abnormal temperatures usually found around power plants. In our plant the men went down like ninepins. Many of them, in their loyalty to the Old Chief, kept on working when they should have been in the hospital.

I am convinced that this mistaken effort to live up to the age-old engineers' tradition of service cost four of our men their lives. As the labor shortage became acute, we saw the Old Chief as the dynamic whirlwind he must have been as a young man; he was here, there, and everywhere and no job was too hard or too dirty for him. As more men dropped off all shifts, as we knew them, went by the board. Those of us who lived any distance from the plant ate and slept there. For almost two weeks we worked twelve hours on and six hours off, then as some of the firemen started to trickle back on wobbly legs, the Old Chief chased them on to lighter jobs while he continued to work like a Trojan.

Those of us who were lucky enough to enjoy good health during this time gave the credit to some particular and peculiar preventative nostrum that we individually swore by.

Aspirin Swallowing

Aspirin swallowing was a favorite. The man who jumped into a 3-man water tender's job favored a finger of whiskey before each meal. One of the firemen leaned toward molasses and sulphur while the engine man believed in a "wee nip" of coal oil at odd moments. While we did not discover a cure-all for Spanish flu, we did discover certain hitherto unknown facts regarding the men we worked with.

Prior to this emergency we regarded one young man as a kind of flighty sort of fellow with a restless disposition, inclined to wander all over the plant. When the crisis came we had every reason to be glad of his wandering habits because he knew every man's job in the plant to perfection. He was worth his weight in gold to us. In fact, we might have had to close down half of the plant if it had not been for this man's wonderful work.

On the other hand there were men whom we had always regarded as very capable men, who were "lost" away from their own particular job and were very panicky and unreliable under pressure. One thing more we discovered, and that was that the power plant may deliver steam and other services in perfect volume and quality, for 364 days of the year, but if everything is not perfect on the 365th day, the factory foreman will howl to the high heavens like a pack of hounds.

Soda Ash

In the early summer of that year the Old Chief told me that he had hired a college student for the job of holiday relief man during the summer. "He tells me," he added, "that he is coming out to be a chemist. Maybe if you don't feel well some morning, he'll make you up a couple of pills."

I was long to remember this young student. I met him the following morning, a tall, thin, white-faced young man, who did not impress me as suitable material for our game. However, he had picked up some good experience in other plants. Out of deference to his chemistry, I started him as a water tender and feedwater-treatment man. Before long he set up, at his own expense, a laboratory for making an analysis of our water every two hours. As he did most of this work on his own time we did not bother him; we thought he was showing off his "college stuff."

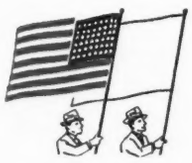
Next, he started on the very hard job of convincing the Old Chief that he could cut his "outage" for boiler cleaning in half, by changing his treatment. The Old Chief discussed it with me—"stuff and nonsense" was his comment. "Water is water and soda ash is soda ash." He admitted that there were all kinds of fancy concoctions on the market. In fact, he knew of an old fellow up in the hills who kept his upright boiler in wonderful shape, by dropping a plug of Macdonald's chewing tobacco in it after every clean out.

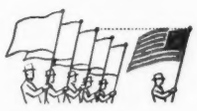
I may state that *our* system of feedwater treatment consisted of determining the grains of hardness in the water by means of a standard soap solution and then adding one and a half ounces of soda ash per grain, for every 1000 lb of water evaporated. To make a long story short, the Old Chief was won over. The chemist had entered the boiler room. Today the tall young man, no longer young, no longer thin, is the nationally known head of one of this country's largest industrial chemistry firms.

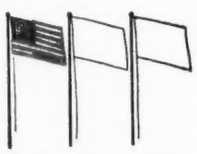
Americans Should Know These

FLAG RULES

When the Flag is being raised or lowered or when it passes in a parade, a man removes his hat with his right hand and places it over his heart while standing at attention. A woman, or a hatless man, places the right hand over the heart. Whenever the Star Spangled Banner is played, a civilian stands and faces the music, with right hand or hat over heart, except when the flag is being lowered, on which occasion he faces the flag. The salute is held until the last note of the anthem is played.







1. The Flag should be displayed from sunrise to sunset. It should be hoisted briskly, but lowered slowly and ceremoniously. The Flag should now be displayed every day.

2. When carried in a procession with other flag or flags, the American Flag should be either on the marching right—i.e., the Flag's own right—or when there is a line of other flags, in center front of that line.

3. When displayed with another flag against a wall from crossed staffs, the Flag of the United States should be on the right, the Flag's own right (the observer's left), and its staff should be in front of the other staff.

4. When a number of flags of States or cities or pennants of societies are grouped and displayed from staffs with the Flag of the United States of America, the latter should be at the center or at the highest point of the group.

5. When flags of States or cities or pennants of societies are flown on the same halyard with the Flag of the United States of America, the latter should always be at the peak, except for the official church flag during services. When flown from adjacent masts, the Flag of the United States of America should be hoisted first and lowered last, and should be at the right of the line (observer's left), and should be as high or higher than any other.

6. When flags of two or more nations are displayed, they should be flown from separate masts at the same height and the flags should be of approximately equal size.

7. When the Flag is displayed from a staff projecting horizontally or at an angle from the window sill, balcony, or front of building, the union of the Flag should go clear to the peak unless the Flag is at half-mast.

8. When the Flag is displayed in a manner other than by being flown from a mast, it should be displayed flat, whether indoors or out. When displayed either horizontally or vertically against a wall, the union should be uppermost or to the Flag's own right, i.e., to the observer's left. In a window it should be displayed with the union or blue field to the left of the observer in the street. When festoons, rosettes, or drapings are desired, bunting of blue, white, and red should be used, but never the Flag.

9. When displayed over the middle of the street, the Flag should be suspended vertically with the union to the north in an east-and-west street or to the east in a north-and-south street.

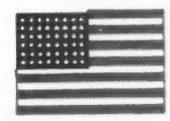
10. On a speaker's platform, the Flag, if displayed flat, should be above and behind the speaker. If flown from a staff it should be in the position of honor, at the speaker's right. It should never cover the speaker's desk or drape over the front of the platform, but bunting may be used for this purpose, if desired, with the blue uppermost.

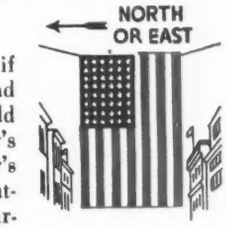
11. When used in unveiling a statue or monument, the Flag should not be allowed to fall to the ground, but should be carried aloft to wave out, forming a distinctive feature during the rest of the ceremony. No object may be placed on the Flag except the Holy Bible.

12. When flown at half-mast, to indicate mourning, the Flag should be hoisted to the peak for an instant and then lowered to the half-mast position; but before lowering the Flag for the day it should be raised again to the peak. Half-mast is one-half the distance between the top and bottom of a mast, the Flag's own width below the peak on a pole or staff.

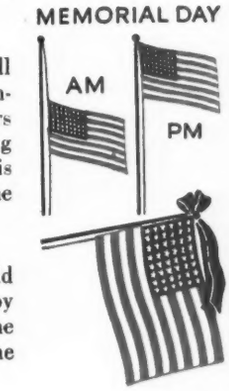
13. When the Flag is displayed on a small staff, as when carried in a parade, mourning is indicated by attaching two streamers of black crepe to the spearhead, allowing the streamers to fall naturally. Crepe is used on a flagstaff only by order of the President.

14. Old, frayed or discolored Flags should be destroyed by private burning, or by some other method in harmony with the reverence and respect we owe to the emblem of our country.





MEMORIAL DAY



The front cover of this issue carries, for the first time in our history, a full-color reproduction of Old Glory, your flag and ours. Americans respect and love it as a matter of course. But that respect is usually expressed casually and without much regard for the rules. We Americans are normally too easily embarrassed to show our true feelings.

Yet, the Stars and Stripes is symbolic of our very freedom, and as such should have our deepest and most intelligent respect—particularly now. It is for this reason that we present, on the preceding page, the Flag Code, based on that adopted by the Second National Flag Conference in Washington, May 15, 1924.

Reprints, on this same stock, suitable for framing or posting, will be sent you free on request.

WHAT'S A FLAG?

WHAT'S A FLAG? What's the love of country for which it stands? Maybe it begins with love of the land itself. It is the fog rolling in with the tide at Eastport, or through the Golden Gate and among the towers of the Green, throwing a shining glory on Lake Champlain and above the Adirondacks. It is the storied Mississippi rolling swift and muddy past St. Louis, rolling past Cairo, pouring down past the levees of New Orleans. It is lazy noon-tide in the pines of Carolina, it is a sea of wheat rippling in Western Kansas, it is the San Francisco peaks far north across the glowing nakedness of Arizona, it is the Grand Canyon and a little stream coming down out of a New England ridge, in which are trout.

It is men at work. It is the storm-tossed fishermen coming into Gloucester and Provincetown and Astoria. It is the farmer riding his great machine in the dust of harvest, the dairyman going to the barn before sunrise, the lineman mending the broken wire, the miner drilling for the blast. It is the servants of fire in the murky splendor of Pittsburgh, between the Allegheny and the Monongahela, the trucks rumbling through the night, the locomotive engineer bringing the train in on time, the pilot in the clouds, the riveter running along the beam a hundred feet in air. It is the clerk in the office, the housewife doing the dishes and sending the children off to school. It is the teacher, doctor and parson tending and helping, body and soul, for small reward.

It is the small things remembered, the little corners of the land, the houses, the people that each one loves. We love our country because there was a little tree on a hill, and grass thereon, and a sweet valley below; because the hurdy-gurdy man came along a sunny morning in a city street; because a beach or a farm or a lane or a house that might not seem much to others were once, for each of us, made magic. It is voices that are remembered only, no longer heard. It is parents, friends, the lazy chat of street and store and office, and the ease of mind that makes life tranquil. It is Summer and Winter, rain and sun and storm. These are flesh of our flesh, bone of our bone, blood of our blood, a lasting part of what we are, each of us and all of us together.

It is the stories told. It is the Pilgrims dying in their first dreadful winter. It is the minute man standing his ground at Concord Bridge, and dying there. It is the army in rags, sick, freezing, starving at Valley Forge. It is the wagons and the men on foot going westward over Cumberland Gap, floating down the great rivers, rolling over the great plains. It is the settler hacking fiercely at the primeval forest on his new, his own lands. It is Thoreau at Walden Pond, Lincoln at Cooper Union, and Lee riding home from Appomattox. It is corruption and disgrace, answered always by men who would not let their flag lie in the dust, who have stood up in every generation to fight for the old ideals and the old rights, at risk of ruin or of life itself.

It is a great multitude of people on pilgrimage, common and ordinary people, charged with the usual human failings, yet filled with such a hope as never caught the imaginations and the hearts of any nation on earth before. The hope of liberty. The hope of justice. The hope of a land, in which a man can stand straight, without fear, without rancor.

The land and the people and the flag—the land a continent, the people of every race, the flag a symbol of what humanity may aspire to when the wars are over and the barriers are down; to these each generation must be dedicated and consecrated anew, to defend with life itself, if need be, but, above all, in friendliness, in hope, in courage, to *live* for.

—*The New York Times,* June 14, 1940.

For Condensers—One Pump or Two?

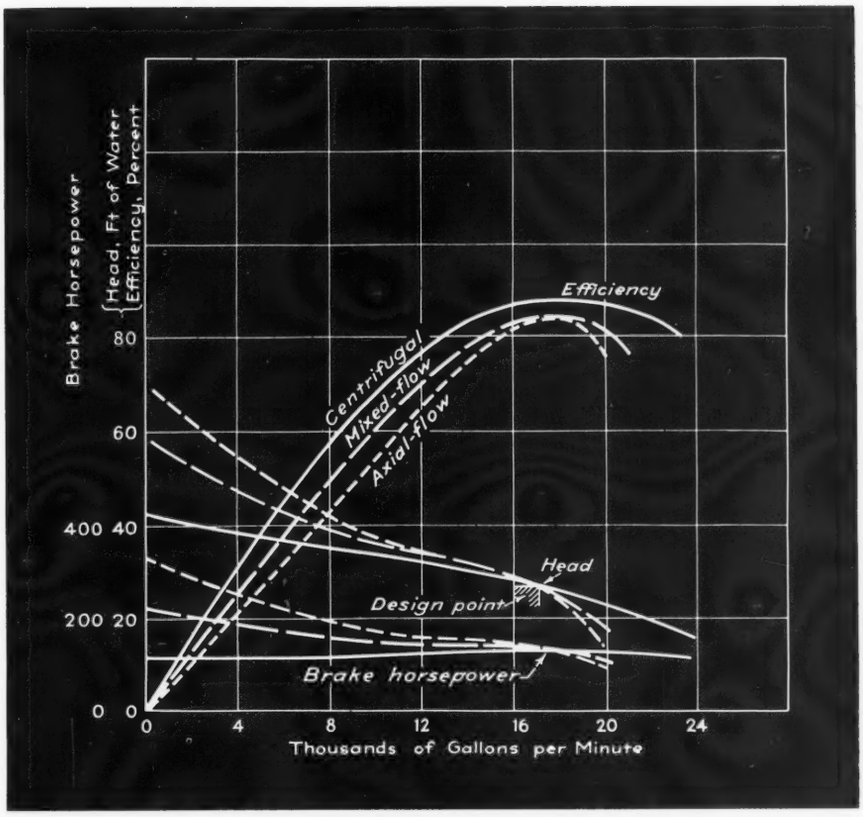


Fig. 1—Characteristic curves for a single-pump installation serving a 15,000-kw turbine showing efficiency, head and horsepower for three pump types

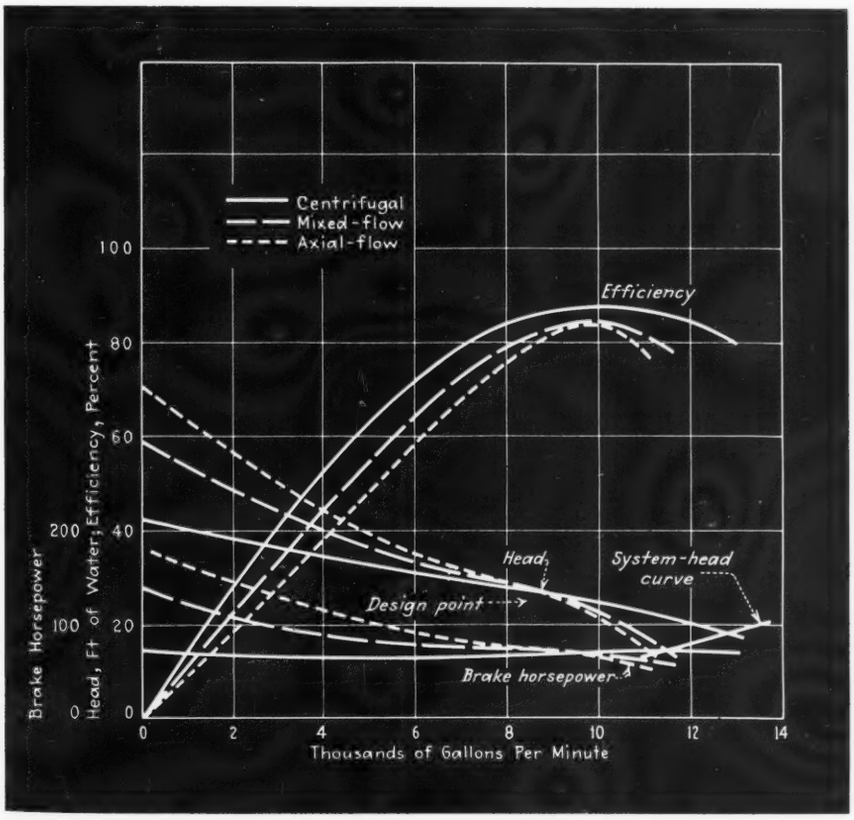


Fig. 2—Twin pumps share the flow equally, but each must also be able to operate singly on half the condenser or serve all tubes at moderate loads

Choice between a single large pump and two half-size circulators depends on cleaning schedules and turbine load curve. H R Mueller,* Allis-Chalmers Mfg Co, illustrates the problem by examples

▶ WHEN BUYING A CONDENSER, the engineer must choose between a single full-capacity circulating-water pump and two half-capacity units. Proper selection depends on the frequency of cleaning expected, and the way the turbine load will vary from hour to hour and from summer to winter. The pump best suited to the installation also affects choice between one and two pumps.

To illustrate the effect of these several factors and the methods of calculation, consider the steps in selecting a pump for a 15,000-kw turbine served by an 18,500-sq-ft 2-pass surface condenser. This condenser requires 17,200 gpm of cooling water which has to be pumped against a total head of 27 ft.

Alternate Pump Types

Three types of pumps are suitable for condenser circulating water service (1) centrifugal (2) mixed flow and (3) axial flow. If a pump of each type is designed for the 17,200-gpm, 27-ft head condition, head, horsepower and efficiency curves for other flow conditions will be about like the curves of Fig. 1. Note that the *centrifugal* pump head and horsepower curves rise least for reduced flows while *axial-flow* designs build up highest head and horsepower on shutoff. *Mixed-flow* pumps have an intermediate characteristic.

Centrifugal pumps operate at low rotative speeds, requiring a motor of large physical dimensions. Higher-speed axial-flow pumps can be driven by physically smaller motors but the drive unit must be capable of greater horsepower output if operation at reduced flows is required.

For the specific example of Fig. 1, a 30x24-in. centrifugal is driven by a 150-hp 385-rpm motor, a 30-in. mixed-flow calls for a 150-hp 580-rpm drive and a 24-in. axial-flow unit requires 200 hp at 860 rpm.

Similar characteristics for 2-pump

* *Engine and condenser department.*

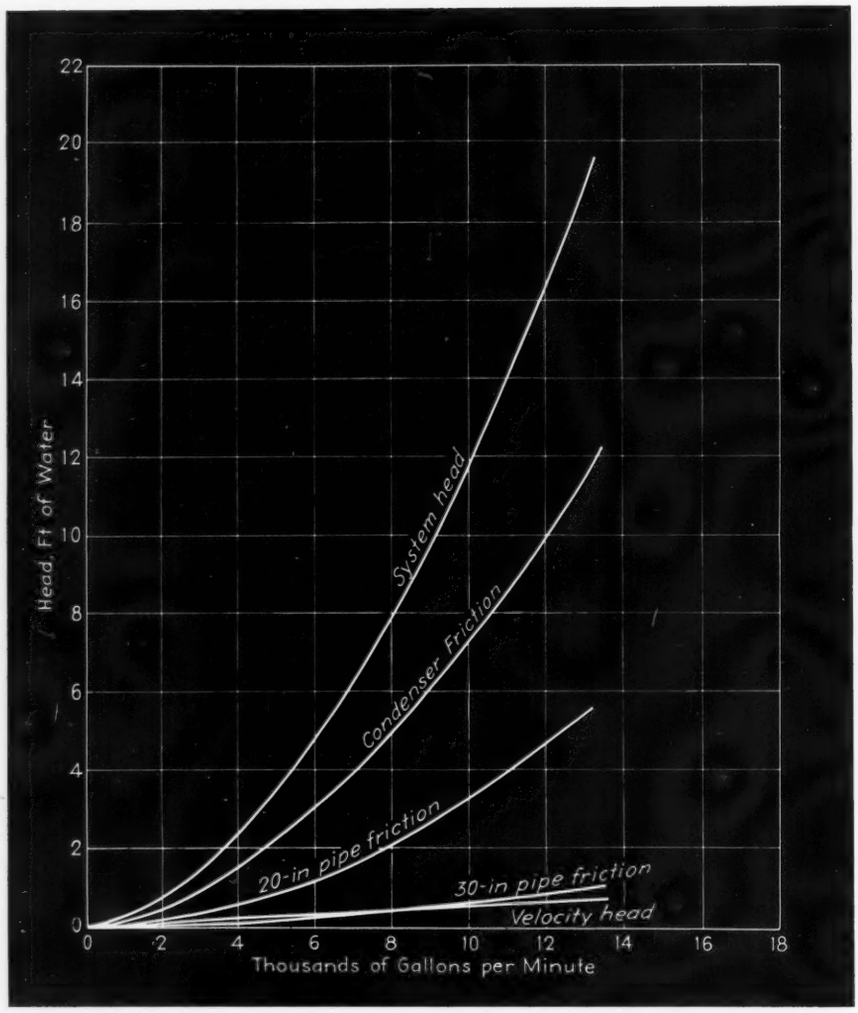


Fig. 3—System-head curve, composed of several component friction-loss quantities, tells what one pump (of two) must do operating alone on the entire condenser

operation, Fig. 2, assume that each pump takes half the flow at the design point, 8600 gpm. In general, the curves are similar to Fig. 1 but at half the flow quantities. A small section of the system-head curve is plotted (see also Fig. 3) to indicate what flow, head and horsepower will be required with one pump supplying the entire tube bank.

Ratings of the half-capacity pumps are: a 24x20-in. centrifugal, driven by a 75-hp 495-rpm motor; an 18-in. mixed-flow, driven by a 100-hp 690-rpm motor; and an 18-in. axial-flow requiring a 125-hp 1150-rpm drive.

A *system-head* curve, Fig. 3, shows the total pumping head that will be required by the condenser friction, pipe friction and velocity-head losses. By plotting the correct portion of this curve on half-capacity pump performance curves, as in Fig. 2, a pump can be selected that gives nearly the same efficiency for 1- and 2-pump operation. In general, this condition gives best overall operating characteristics. In Fig. 2, the 2-pump operating condition is represented by the cross-hatched design point; the other, single-pump condition is found from the intersection of the performance curve and the system-head curve for each pump.

Wide range of good efficiency near the design point makes the centrifugal pump especially desirable for 2-pump operation, as the half-capacity centrifugal can be chosen so that efficiency at both points of operation are within a few percent of the maximum pump efficiency. The other two types have more sharply peaked efficiency curves.

Because the head of a centrifugal pump falls off only slightly with increased flow above the design point, one pump (of two) delivers much more water when operating alone on the entire condenser than when each serves half the tube bank. For the example, Fig. 2, one centrifugal (of two) delivers 48% more water when running alone as compared with 33% more for the mixed-flow unit and 29% for the axial-flow design.

Thus the 2-pump condenser loses only one-fourth of its cooling water flow with centrifugal pumps and approximately one-third with the others. It should also be noted that the power consumption of two half-capacity pumps is only slightly greater than that of a single large pump.

One of the most important factors affecting the choice of two pumps against a single one is the need for mechanical cleaning of heat-transfer surfaces. If water conditions are such that chemical and mechanical means will not prevent tube fouling while the unit is running, a divided-waterbox condenser allows shutting down each half alternately for cleaning.

Shutting down one half of the condenser for cleaning during light-load periods occasions only a slight rise in absolute pressure (decrease of vacuum) and practically no increase in turbine steam rate. If only a single pump serves the entire condenser without divided waterbox and valving, the unit must be taken out of service entirely for tube cleaning.

Auxiliary Power Economy

The 2-pump arrangement also offers economy in use of auxiliary power by normal operation of one pump on the entire condenser when load and water-temperature conditions are favorable. Fig. 4 shows a plot of the necessary data for finding the balance between added steam to the turbine and saving in pump power.

Full lines indicate 2-pump absolute pressure against steam flow to an 18,500-sq-ft condenser for 40-, 60- and 80-F water temperatures. Dashed lines show the increase in condenser pressure when only one pump is operated, serving the entire tube bank (plotted for a centrifugal installation). Constant-load lines for the turbine at ¼, ½, ¾ and full load are shown. These can be calculated readily from turbine contract data.

The increase in absolute pressure at ¼ load, for example, with 60-F cooling water is only about 0.03 in. of mercury and the increase in steam load is only about 100 lb per hr using one pump. At ¾ load with 80-F circulating water, the increase in absolute pressure amounts to about ¼ in. of mercury, representing a considerable increase in the steam flow to the turbine to enable it to carry the same load.

Many condenser installations have load conditions favorable to 1-pump operation for periodic cycles. In such cases the selection of two half-capacity pumps is clearly indicated. For such conditions, the range of operating loads for which 1-pump operation is more economical can be calculated and plotted as indicated by the cross line

of Fig. 4. To the left of and below this line, it is better to run a single pump; to the right of and above, a net saving will be made by running both pumps.

The saving in power consumption for the 18,500-sq-ft condenser of Fig. 4 was calculated by using the brake horsepower needed to drive the pumps and the input-output efficiencies of standard electric motors. Assuming that centrifugal pumps serve this condenser, the difference in power for two pumps over one pump would be about 55 kw. This quantity of electric power can be converted to a steam flow increment by using the vacuum-correction curve of the turbine-generator in conjunction with its steam-rate curve.

Calculating Balance

Balancing the steam equivalent of the added pump power against additional steam to carry constant load against higher backpressure for a range of loads and circulating-water temperatures determines the balance point for each water temperature, which can then be plotted as in Fig. 4.

Where the increase in steam flow caused by single-pump operation is equal to or less than the kw saving in pump power converted to lb per hr of steam, it is more economical to operate only one pump. The increased steam flow is calculated by drawing a vertical line upwards from the point where any constant-load line intersects the performance curve for 2-pump operation (inset in Fig. 4) and then drawing a horizontal line from the point where this same constant-load line intersects the performance curve for single-pump operation until the line meets the vertical previously drawn. The horizontal leg of the triangle thus formed is the increase in steam flow to maintain constant load when switching to single-pump operation.

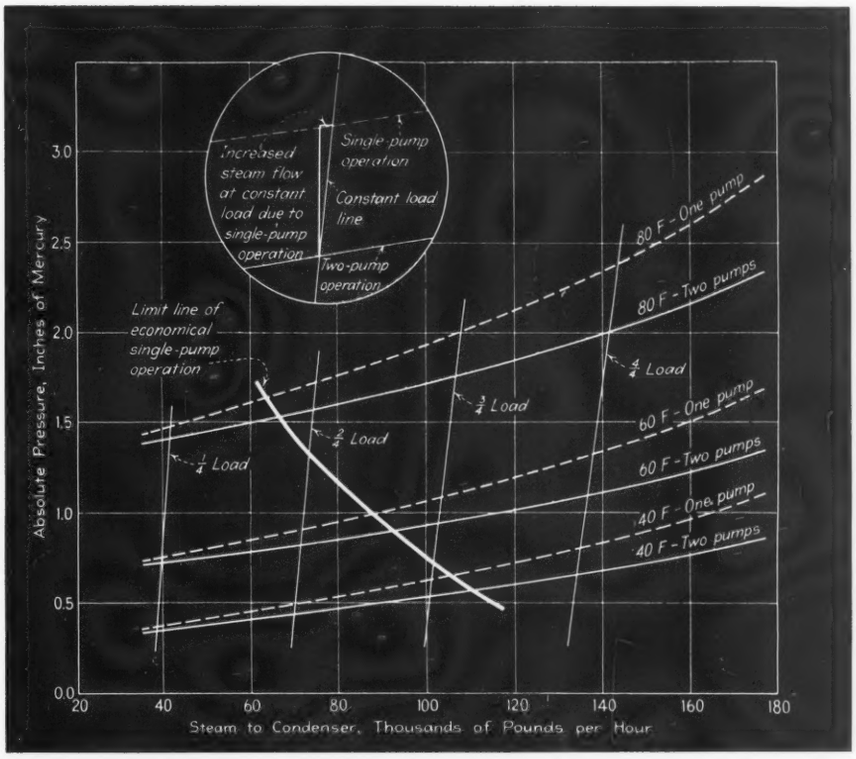


Fig. 4—This chart balances increased steam flow to main turbine at higher backpressure for single-pump operation against added power to drive the second pump

The inset of Fig. 4 is magnified to illustrate the method of determining increased steam flow. Actual calculations are normally made from a large plot of turbine performance or can be calculated approximately from the turbine vacuum-correction factor curve.

The limit line of Fig. 4 would seem to indicate that single-pump operation would be used for only a few hours a year. When water-temperature variations are taken into account, however, as in Fig. 5, it is noted that single-pump operation is more economical at loads below three-fourths turbine capacity for nearly five months of the year.

Water Temperatures

While the water-temperature curve of Fig. 5 applies to rivers of a middle-western location, a similar plot can be made up for the warmer or colder conditions prevailing at any plant site. For the conditions indicated, it is never economical to operate with two pumps below ¼ load and operating schedules should be set up to run on one pump below ½ load for eight months of the year. For generally warmer water conditions, of course, the period of 1-pump operation decreases for the same load conditions.

Similar calculations can be made for axial-flow and mixed-flow pumps when a new condenser is to be purchased. All these several factors of load, head-capacity characteristics, cleaning schedules and water temperatures are interrelated so that most efficient condenser design results from full knowledge by the manufacturer of the conditions under which condenser and pumps must function.

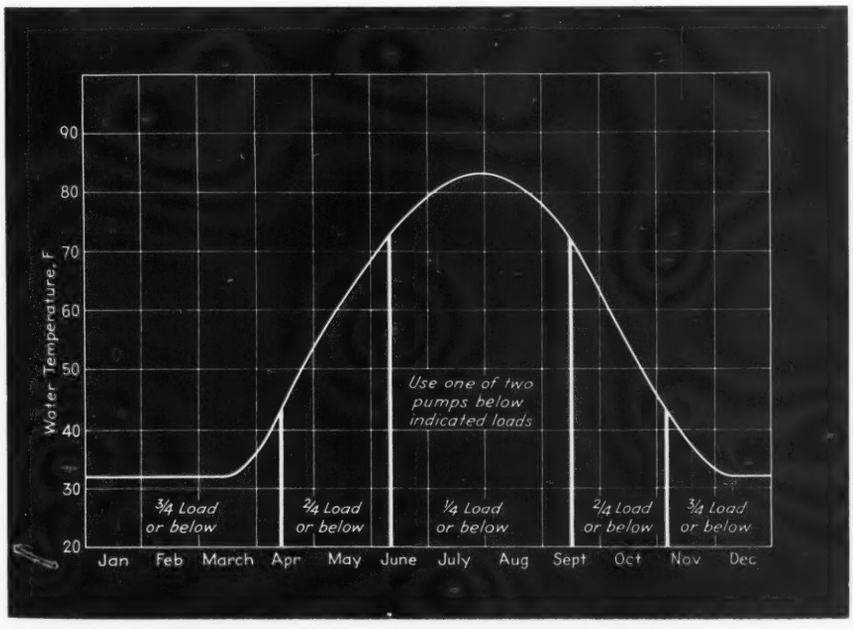
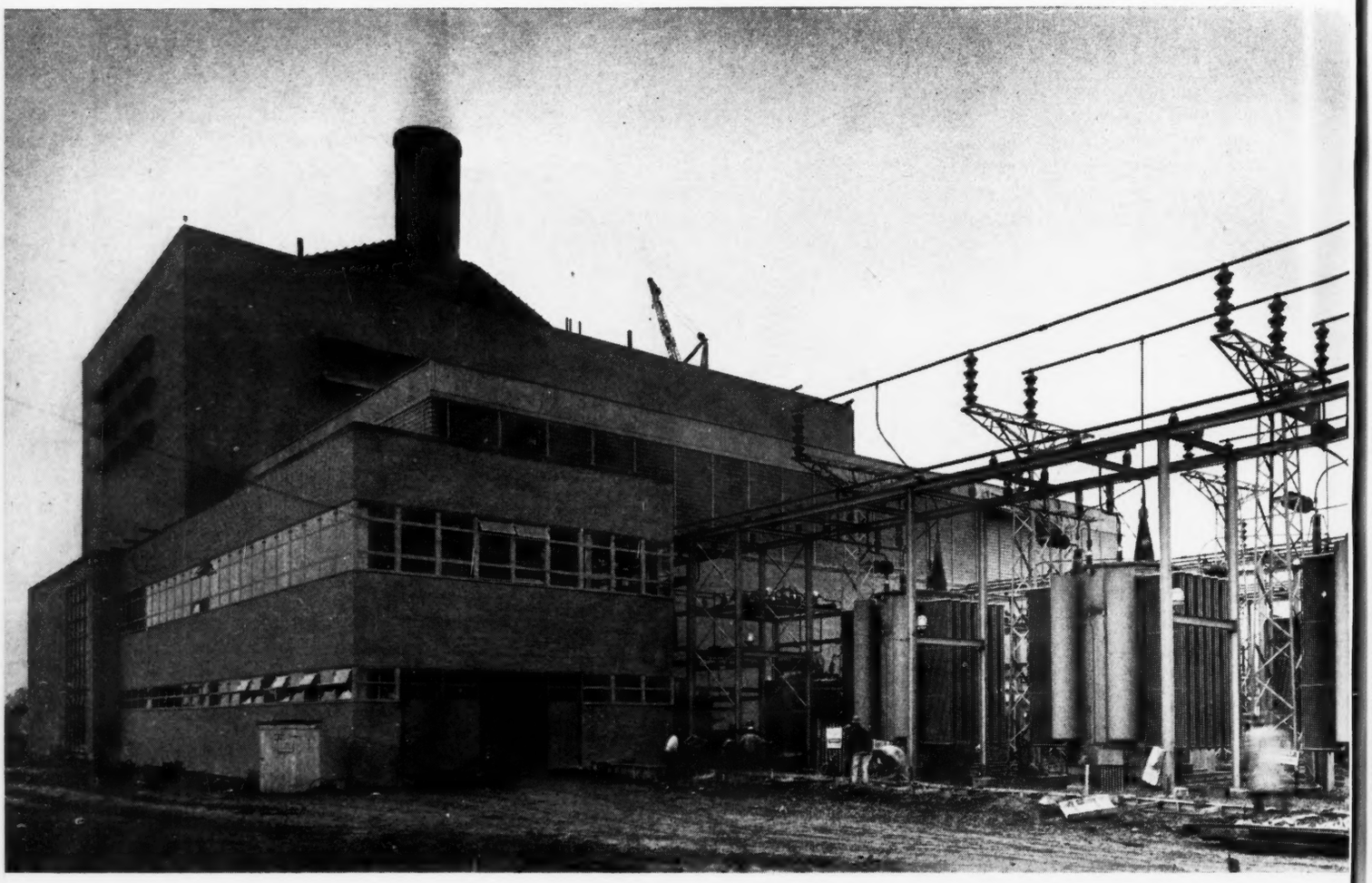


Fig. 5—In summer, single-pump operation is more economical below quarter load. Cooler water increases load point at which only one pump should be operated

Two 850-Psi 900-F Watts Bar Steam Units



By GEORGE E MORGAN
Chas T Main, Inc

Completed in 18 months, Tennessee Valley Authority's first modern steam plant now contributes 120,000 kw to the war production plants of the Southeast. Coal rate is below 0.9 lb

▶ THE FIRST 120,000 kw of the Watts Bar steam plant, authorized by Congress about a year after the start of construction of the Watts Bar hydroelectric project (July 31, 1940) started operation of the first 60,000-kw unit on Jan. 30, 1942, just one day less than 18 months after authorization. The unit actually was put on the line, however, for a few hours during the previous week after nearly a month of preparation.

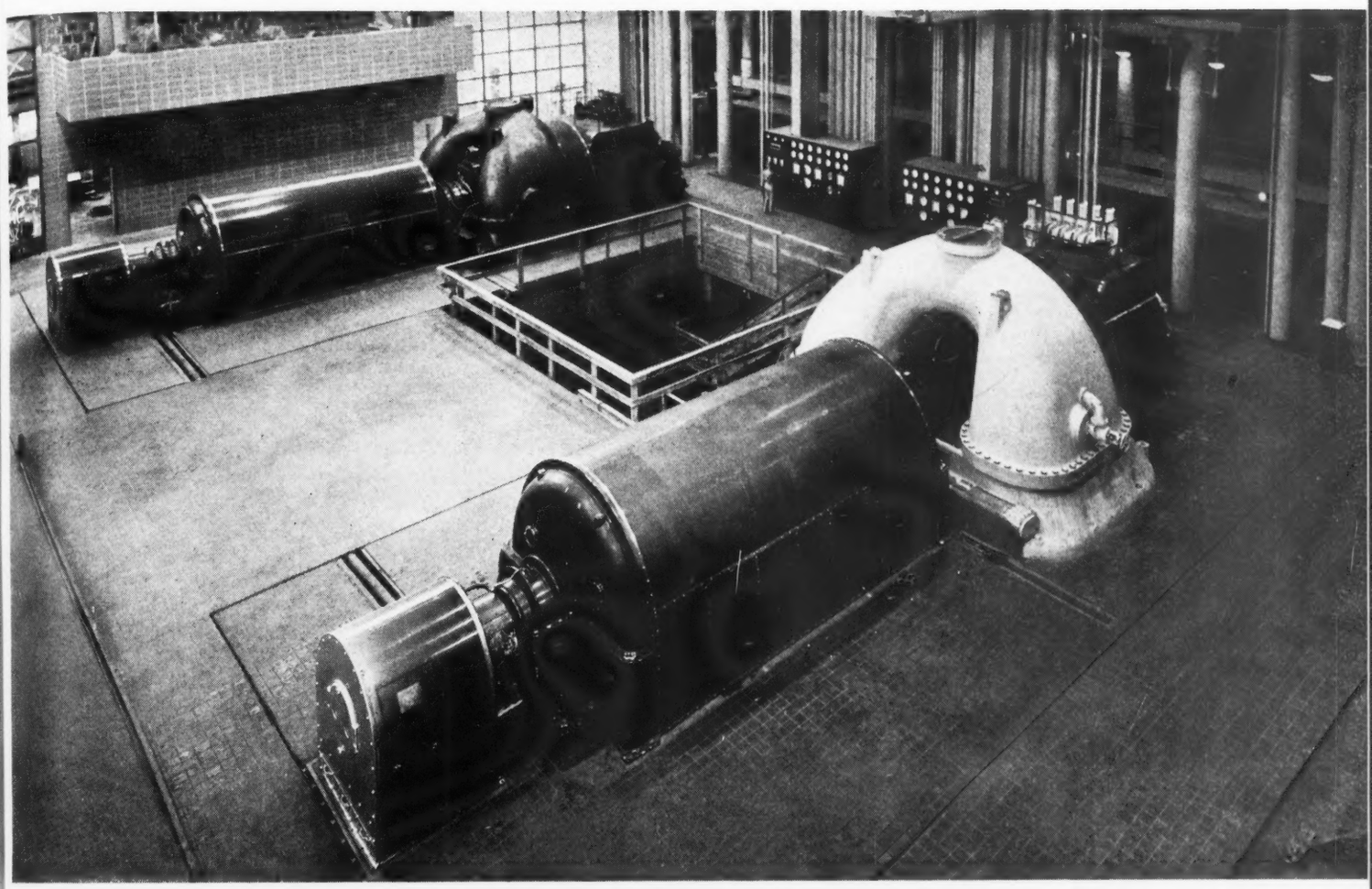
The plant heating boiler served as an evaporator to make an initial fill of distilled water for the steam generator, steam being condensed in the 14th-stage closed heater by river water. The 14th-stage heater also heated the water circulated through the steam generator for drying out between applications of insulation before the steel casing was erected. The heating boiler furnished steam for this operation.

After boiling out the steam generator, testing other equipment, and making necessary temporary provisions to take care of the lack of certain equipment, (all now in service) the unit was started with a load of 20,000 kw, gradually increased to 60,000 kw. Closed feedwater-heater controls required some adjustment (the high-pressure heaters are designed for integral drain subcooling) but even with some heaters temporarily out of service it was possible to carry full load and put power, badly needed for war production, into the T V A system.

When the stage heaters were later placed in service, the quantity of bleed steam was controlled by motor-operated valves at the heaters so that the boiler-feed temperature was slowly increased to approximately 400 F leaving the 5th-stage heater and entering the economizer. This enabled operators to make necessary adjustments of controls without serious interruption of the feedwater cycle.

Previous articles (see later references) regarding this plant have pointed out that circulating water comes from the pool above Watts Bar Dam, approximately 3600 ft upstream from the steam plant. A 78-inch diameter precast concrete pipe brings circulating and service water for 120,000 kw to the plant by gravity. It was necessary to bring pool level above the dam to elevation 723.0 ft for sufficient

Serve TVA War Loads



Left—Simplified modern brick structure houses three 60,000-kw units. Stack and breeching for third unit not yet constructed. Office bay in foreground. Right—Exhaust casing of Unit B has received its priming coat in this photo. Main steam, other piping and conduits, visible on the boiler-room side of the crane columns, will be hidden by a division wall when construction is complete

head at the intake structure and screens. Normal pool level will be at elevation 740.0 ft.

Flow of circulating water is controlled by butterfly valves in the outlet piping of the condenser so that the unit may be operated at most economical vacuum, governed by the temperature of the circulating water.

The second unit was placed in service March 11, 1942, with a load of 10,000 kw. We had, of course, taken care of most of the adjustments that were found necessary for the first unit before starting and the second machine was brought up to full load with little effort. On March 16 both units were carrying full rated capacity of 60,000 kw or better.

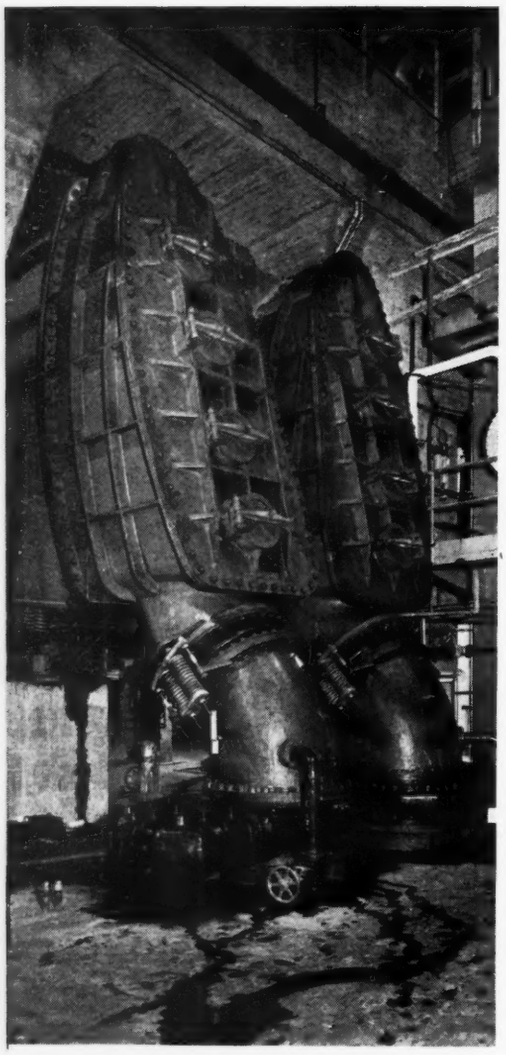
Operating results parallel closely the anticipated heat-balance figures, but at this writing some construction is still going on. Insulation of the piping and equipment for both units has not yet been finished. Actually, the coal rate up to March 31 was 0.87 lb per kwhr, compared with 0.89 lb anticipated with coal of 13,500 Btu per lb as fired. Of course high vacuum was obtained with the cool circulating water available during the period. When all adjustments are made, insulation completed and allowance considered for variations in load, indications point to results better than anticipated design figures.

Design and arrangement of practically all auxiliaries are such that the main units can be operated at full rated load, even though an individual primary auxiliary is taken out of service. All heaters except the deaerators can be bypassed, and the deaerator tank can be used for boiler-feed-pump suction storage without actually heating or deaerating the water. Automatic heater controls can also be manually operated. Feedwater can be controlled to the boiler by remote manual operation of the auxiliary motor-operated valve at the auxiliary boiler-feed side of the economizer inlet header.

There is one spare boiler-feed pump for each two boilers. It will automatically cut into service in the respective feedwater cycle of either unit.

Station-service water pumps, air compressors and other such auxiliaries either are in duplicate or have sufficient interconnected capacity to prevent reduction in power output to the system should any of them need to be taken out of service for maintenance, repair or inspection.

There are no steam-driven auxiliaries; even the auxiliary lubricating-oil pump of the turbine-generator is motor driven. The turning-gear oil pump has sufficient capacity to bring the unit off the line. Should there be electrical or other failure of this pump, an auxiliary dc motor-driven



Inlet-end view of single-pass divided-water-box condenser reveals conspicuous absence of circulating-water pumps. Floor elevation here is 41 ft below normal level of pool above dam from which circulating water flows by gravity

turning-gear oil pump will be brought into service automatically. This pump, as well as the motor-operated valves and other electrically operated mechanical controls, receive dc power supply from the station storage battery, kept charged by a motor-generator set.

Auxiliary power is taken from four individual 7500-kva 3-phase transformers connected by motor-operated disconnects to the 13.8-kv delta buses of the main transformer banks. Connected load, about 15,300 kw for auxiliaries of four ultimate units, and about 1800 kw for coal handling and station service, totals 17,100 kw. Normally, auxiliaries of each unit will be served from the auxiliary transformer connected to that unit with bus-sectionalizing breakers open and with coal-handling and station-service loads split between two units.

In case of loss of supply to a bus section, a breaker will close automatically to an adjacent bus section, and as the bus is energized through the transmission line between the main switchyard and the steam plant before any unit at the steam plant is in service, it is not necessary to have steam-driven auxiliaries as spares to the motor-driven auxiliaries. Also a 600-kva source of outside power provides for lighting, heating, pumping, coal handling, crane and machine shop operation during periods when the steam plant is down.

Auxiliary Switchboards

The four switchboards for receiving and distributing 2300-v auxiliary power are of steel-cubicle type with drawout air circuit breakers and induction overcurrent relays. Four switchboards for receiving and distributing 440-v auxiliary power are also of steel-cubicle construction with air circuit breakers, the incoming and sectionalizing breakers being of the drawout type, with induction overcurrent relays, and fixed feeder breakers with disconnecting switches, fuses, and thermal relays.

The trend in central-station design during the last several years has been toward elimination of duplicate items of equipment for standby or spares. The Watts Bar turbines will normally operate on the unit basis (one turbine —one boiler) with their individual complement of boiler-feed pump, heaters and other auxiliaries.

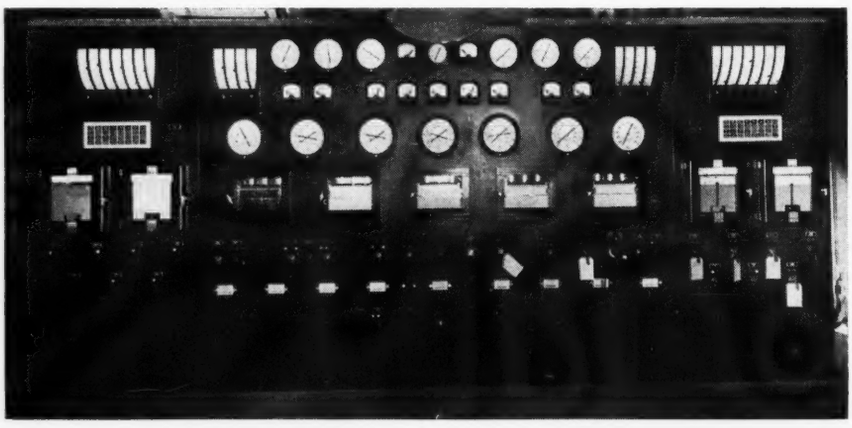
However, the two units now in operation, are cross connected by high-pressure steam and boiler-feed piping so that with one boiler out of service, the two turbine-generators can remain on the line, with an output from the two units approximately 10,000 kw greater than if both the boiler and its turbine were down together. This feature of design will not be used between existing and future units, the complications of the feedwater cycle and main steam piping making it impractical for more than one pair of units.

While it was appreciated that the first two units now in operation would be a relatively small part of the system capacity, the ultimate steam plant at Watts Bar will become an important factor in "priming" much of the secondary energy now under contract, and for reducing the operation of older less efficient steam plants when the entire steam capacity is required for long periods during extremely dry years, or during periods of extreme flood.

Load on the steam station is controlled at the hydro station site control building upstream from the steam plant. This central control point will take care of the ultimate installation of hydro units, two of which are now in service, as well as the future installations at the steam plant.

The turbine operator at the steam plant can, of course, limit load on a machine by the turbine load-limit device while bringing it up to the capacity required. This is necessary only because he must parallel the boiler output. Subsequent load changes are made by the operator at the main control building at the hydro plant. He indicates simultaneously through an annunciator system on all control boards that load is to be changed.

Operators acknowledge from each board in the steam plant the control operator's indications to "standby" or "load change" by pushing the "standby" buttons at each board in the plant. This indicates on the annunciator panel at each of the turbine, boiler and pump boards and at the central control board, that all are ready. The annunciator system within the steam plant also indicates trouble with, or failure of, major items of equipment, as well as im-



Pump and heater control panel for first two units, on condenser-pit floor, tells operator pressures, flows, temperatures and levels of the complete feedwater cycle. This panel controls heaters, heater bypasses and drains, boiler-feed, hotwell and other feed-cycle pumps. Note multipointer pressure gages and strip-chart recorders

portant changes in normal operating conditions. Each control panel has its own dial telephone station for communication between control points.

Previously published data includes a condensation in the November 1941 issue of POWER of a paper by G R Rich of the Tennessee Valley Authority and R T Mathews of Chas T Main, Inc, presented before the A S M E at Louisville, Ky. This article included a map of the system and a cross-section of the plant. The original paper, published in the November, 1941, issue of *Mechanical Engineering*, contained data on the system including graphs showing the relation of hydro and steam capability for average and for dry years. Comments on the paper by the author of this article were published in April 1942 *Mechanical Engineering*.

The Watts Bar steam plant was designed and built by the Tennessee Valley Authority's own forces under the supervision of T B Parker, chief engineer. Design was in charge of George R Rich, chief design engineer, assisted by Chas T Main, Inc, consulting engineers of Boston, Mass. Construction came under the supervision of A L Pauls, chief construction engineer and F C Schlemmer, project manager. The author acted as Knoxville representative for Chas T Main, Inc. and as head steam engineer for the Tennessee Valley Authority.

PRINCIPAL EQUIPMENT—WATTS BAR STEAM PLANT

Tennessee Valley Authority

Coal-Handling Equipment:

Coal received by railroad with future provision for barge unloading. Storage capacity 200,000 tons. Bunker capacity per boiler 1250 tons
Rotary car dumper.....Link-Belt Co
Belt-conveyor systems, 400 tons per hour.....Jeffrey Mfg Co
Drag-scraper storage and reclaiming system....Sauerman Bros, Inc
Coal crusher.....Jeffrey Mfg Co
Conveyor belts.....Boston Woven Hose & Rubber Co
Railroad track scales.....Fairbanks, Morse & Co
Car puller, drum (full cars).....Clyde Iron Works
Car puller, capstan (empty cars).....Link-Belt Co
Structural steel for coal-handling...Pittsburgh Bridge & Iron Works

Steam-Generating Equipment:

Boilers and furnaces.....Babcock & Wilcox Co
Each, 600,000 lb per hr at 900 psi, 900 F, 66-in. upper drum, 30-in. lower drum, open-pass design, slag-tap primary furnace, 11,500 sq ft boiler heating surface, 14,660 sq ft superheater surface and a steaming economizer of 20,820 sq ft
Air heaters, Ljungstrom, regenerative.....Air Preheater Corp
ID and FD fans, duplex units, two per boiler..American Blower Corp
800-hp, 720-rpm motor drive
Pulverizers, raw-coal feeders, 4 per boiler....Babcock & Wilcox Co
3 required for 600,000 lb per hr
Primary-air fans, integral, with pulverizers.....Clarage Fan Co
Burners, 8 per boiler.....Babcock & Wilcox Co
Coal scales, 4 per boiler.....Richardson Scale Co
Gage glasses, bi-color.....Diamond Power Specialty Corp
Soot blowers, steam.....Diamond Power Specialty Corp
Hydrojet system dust and slag removal.....Allen-Sherman-Hoff Co
Includes slag and dry-ash hoppers
Stack and breeching.....Connery Construction Co
Boiler-water-treatment equipment.....Permutit Co

Turbine-Generators and Auxiliaries:

Turbine-generators, two, 60,000-kw each.....General Electric Co
Capacity, 66,667 kva each, 0.9 pf. Single-cylinder, 17-stage, 850 psi, 900 F, 2-in. Hg abs, 1800-rpm, 3-phase, 60-cycle, 13,800-v, air-cooled generator with 1¼ rpm turning gear. Motor-driven auxiliary oil pump, one ac and one dc motor-driven turning-gear oil pumps. Direct-connected exciter, 250-v, 720-amp
Condenser, single-pass, divided water box.....Foster Wheeler Corp
Mounted on springs and bolted solid to turbine exhaust. Condensing surface, 40,000 sq ft, ⅞ in. OD. No. 18 BWG Admiralty tubes, 26-ft long, expanded at both ends

Heaters and Evaporators:

Extraction heater, 14th stage.....Westinghouse Elec & Mfg Co
2 pass, surface 2410 sq ft, tubes 150 psi and shell 50 psi
Deaerating heater, 11th stage.....Worthington Pump & Mach Corp
600,000-lb capacity, separate 12,000-gal storage tank
Extraction heaters, 8th and 5th stage..Westinghouse Elec & Mfg Co
Horizontal, 2 pass, 2200 sq ft each, tubes 1500 psi, shell 300 psi
Evaporator, single effect, 8000 lb per hr
Westinghouse Elec & Mfg Co
Evaporator preheater.....Cochrane Corp

Pumps:

Boiler-feed pumps, one per boiler.....Ingersoll-Rand Co
One spare for two boilers, split casing, 6-stage, 3600-rpm, each 1290 gpm, 2980-ft head
Hotwell pumps, 2 per unit, 3-stage 1150-rpm....Foster Wheeler Corp
Each 1100 gpm, 315-ft. head
Drain pump, 14th-stage htr, 100 gpm, 315-ft head....Ingersoll-Rand Co
Drain pump, 8th-stage heater, 100 gpm, 80-ft head..Ingersoll-Rand Co
Gland-seal pump, 100 gpm, 150-ft head.....Ingersoll-Rand Co
Distilled-water pump, 400 gpm, 315-ft head.....Ingersoll-Rand Co
Condensate drain-tank pump, 100 gpm, 300-ft head.Ingersoll-Rand Co
Service-water pump, 1200 gpm, 170 ft head.....Dayton-Dowd Co
Ash-sluice pumps, 2 for plant, 1150 gpm, 260-ft head.Dayton-Dowd Co
Ash-sump pumps, 2 for plant.....Allen-Sherman-Hoff Co
Each 1000 gpm, 100-ft head
Station sump pumps, 2 for plant.....Peerless Pump Co
Each 1000 gpm, 38-ft head
Screen-washing pumps, 2 for plant.....Dayton-Dowd Co
Each 720 gpm, 200-ft head
Fuel-oil pumps, 2 for plant.....Worthington Pump & Mach Corp
Each 20 gpm, 125-ft. head
Insulating-oil pump, 100 gpm, 40-lb..Worthington Pump & Mach Corp
Lubricating oil pumps, 4 for plant..Worthington Pump & Mach Corp
Each 50 gpm, 55-lb head
Feedwater-chemical pumps.....Hills-McCanna Co

Piping and Valves:

Steam and feedwater piping, high-pressure steam.....Grinnell Co
Bleed steam, boiler-feed and condensate piping systems, all welded. All other piping by TVA
Gate valves for main-steam and feedwater..Chapman Valve Mfg Co
Check valves, tilting check.....Chapman Valve Mfg Co
Bleeder non-return valves.....Atwood and Morrill Co
Boiler non-return valves.....Edward Valve and Mfg Co
Blowdown valves, tandem assembly.....Yarnall-Waring Co
Circulating-water gate valves, 42 in. (inlet).Chapman Valve Mfg Co
Circulating-water pivot-type valves, 42 in....Chapman Valve Mfg Co
Rubber expansion joints, 42 in.....U. S. Rubber Co
Safety and relief valves.....Manning, Maxwell & Moore, Inc
Drainer valves, pilot-operated, controlled.....Swartwout Co
Pressure-reducing valves.....Swartwout Co
Steam traps, impulse.....Yarnall-Waring Co
Steam traps, bucket.....Armstrong Machine Wks
Strainers, service water.....Elliott Co
Expansion joints.....E B Badger & Sons Co
Heat insulation for piping and ducts....Brooks Fisher Insulation Co
Johns-Manville material

Meters and Controls:

Combustion control, superheater-temperature control.Bailey Meter Co
Feedwater control, three element.....Bailey Meter Co
Boiler panel board.....Bailey Meter Co
Boiler-feed-pump bypass control.....Republic Flow Meters Co
Multi-point pressure gages, multi-pen strip-chart recorders manometers
Turbine and pump panel boards.....Republic Flow Meters Co
Turbine supervisory instruments.....General Electric Co
Pressure gages and dial therm...Manning, Maxwell and Moore, Inc.
Temperature, conductivity and CO_2 recorders..Leeds & Northrup Co
Pressure recorders.....Foxboro Co
Industrial thermometers.....Taylor Instrument Co's

Electrical Equipment:

Transformers, main generator, 3 per unit.....Moloney Electric Co
Single-phase, 21,000 kva (63,000-kva bank), self-cooled, 13.2/2.4kv
Transformers, auxiliary, 1 per unit, 7500 kva..Allis-Chalmers Mfg Co
3 phase, 13.2/2.4 kv, 60 cycles
Transformers, auxiliary, 1 per unit, 750 kva....Allis-Chalmers Mfg Co
3 phase, 2.4/0.48 kv, 60 cycles
Transformers, auxiliary, 1 per unit, 600 kva....Moloney Electric Co
3 phase, 13.2/0.48 kv, 60 cycles
Lightning arresters, 1 per unit, 161 kv, 3 phase..General Electric Co
Generator oil circuit breakers, 15 kv, 3000 amp....General Electric Co
Oil circuit breakers, 161 kv, 1200 amp..Westinghouse Elec & Mfg Co
Outdoor disconnect switches.....Delta Star Electric Co
Control and relay boards.....Westinghouse Elec & Mfg Co
Auxiliary power boards, 440 volts.....Trumbull Electric Mfg Co
Auxiliary power boards, 2300 volts.....General Electric Co
Battery-charging motor-generator set, 250 v....Electric Products Co
Storage battery, 250 v, 480 amp-hr.....Electric Storage Battery Co
Motor operators for valves, Limitorque.....Philadelphia Gear Wks

Miscellaneous:

Air compressors, 4 for plant.....Worthington Pump & Mach Co
Includes station service and controls
Insulating-oil purifier.....De Laval Separator Co
Lubricating-oil purifying equipment.....De Laval Separator Co
Oil-storage tanks.....Lucey Boiler & Mfg Co
Elevator, passenger.....Warner Elevator Mfg Co
Precast-concrete circulating-water pipe, 78 in....Lock Joint Pipe Co
Stairways and platforms.....General Bronze Corp
Structural steel and coal bunkers for powerhouse..Fort Pitt Bridge Co
Steel for switchyard.....Bethlehem Steel Co
Traveling water screens.....Link-Belt Co
Turbine-room crane, 75 tons.....Reliance Machine Co
Heating boiler.....Brownell Co
Refrigerating equipment for air conditioning....York Ice Mach Corp
Unit heaters.....American Blower Co
Ventilating fans.....Clarage Fan Co; New York Blower Co; Ilg Electric Ventilating Co; Herman Nelson Co
Sluice gates, 6, 6 ft x 8 ft.....Mueller Co
Mill seal blowers, 1 per unit.....American Blower Co

"Light-Load" Unit Proves Successful in Brooklyn, Iowa, Municipal Diesel Plant

▶ THE NEW BROOKLYN, IOWA, municipal electric plant is as modern and streamlined as the diesel-powered Rockets that roar along the Rock Island tracks behind the plant. Serving an agricultural community of some 1400 inhabitants, this 700-hp diesel-generating plant is an outstanding example of the results that can be attained, even in a small plant, by careful attention to arrangements and to the multitude of details involved in design and construction of such an improvement. It shows what can be accomplished when a plant is engineered rather than just "put together."

An outstanding feature of the plant and the one which first impresses a visitor is its clean-cut appearance, which results from the modern architectural design employed and from the carefully arranged interior. A second feature is the use of a small high-speed, diesel-generating unit for carrying the light loads which occur late at night and on Sundays and holidays.

The plant not only houses the generating equipment but also provides complete facilities for the business and commercial functions of the municipal electric system. These requirements are met by the office, the garage, and the storeroom. As the building is near the business district, less than a block from the main street, all collections and other business are transacted at the plant.

The lot on which the plant is located allows space for oil-storage tanks and a cooling tower. Unloading facilities for fuel oil are provided along the Chicago, Rock Island & Pacific Railway Co tracks just behind the plant. The plant is prominently displayed to travelers on U. S. Highway No. 6—the through highway running along one side of the plant. Reference to the photographs and to Fig. 1 will give a better idea of the general arrangement of the plant than any further description.

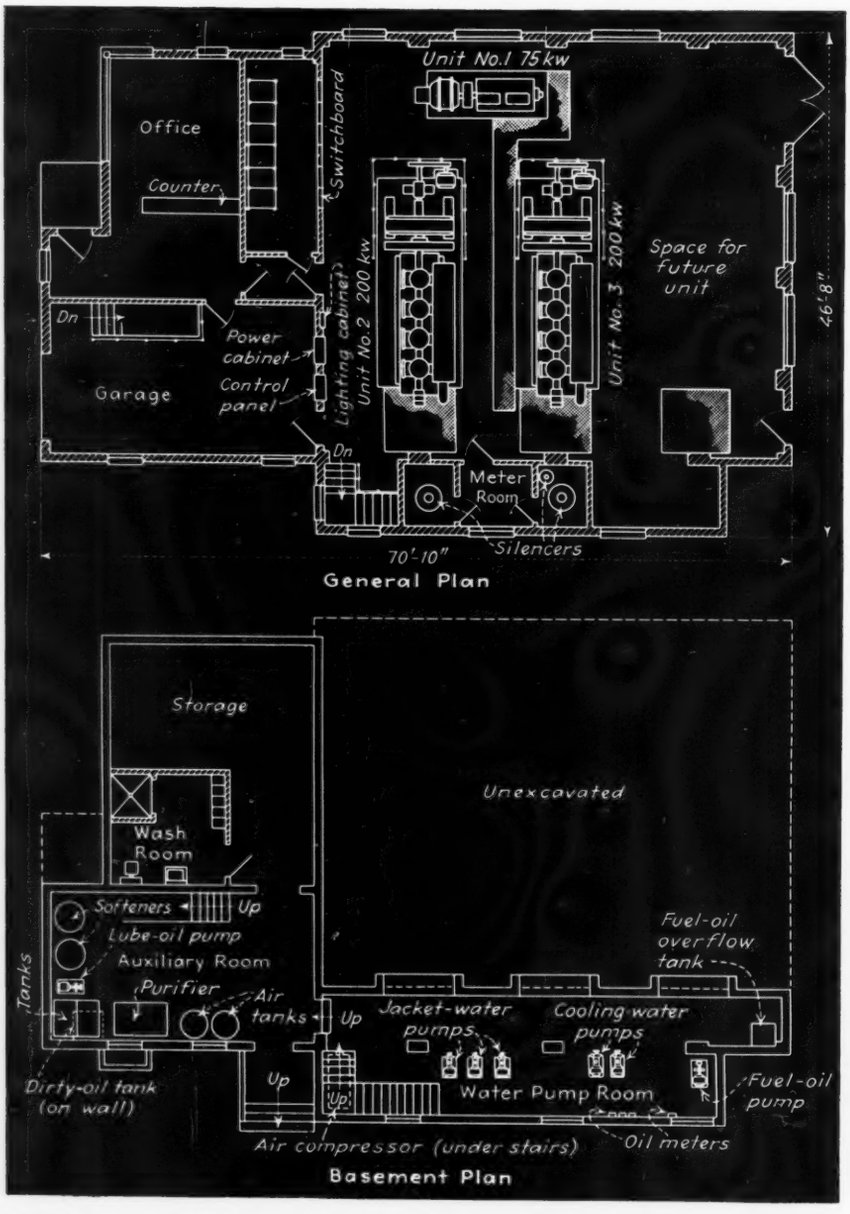


Fig. 1—General and basement plans show layout of engines and auxiliary equipment

Main Engines

The diesel generating equipment installed in the Brooklyn plant consists of three units; two are slow-speed units, while the third is a high-speed "tractor" unit. The two slow-speed machines are Fairbanks, Morse & Co, 4-cylinder, 14x17-in. 2-cycle mechanical-injection engines rated at 300 hp, each direct-connected to a 200-kw 250-kva 3-phase 60-cycle 2400-volt Fairbanks, Morse & Co generator. The high-speed unit is a Caterpillar Tractor Co 6-cylinder vertical 5¾x8-in. 4-cycle 900-rpm engine rated at 105 hp and direct-connected to a 75-kw 93.8-kva 3-phase 60-cycle 2400-volt General Electric Co generator.

The 75-kw unit may be used to: (1) carry light loads from about 11:00 p.m. until 5:00 a.m. and for a longer period on Sundays and holidays, and (2) operate with one of the 200-kw machines to carry peak loads of short duration which exceed the capacity of the 200-kw unit. This arrangement is admittedly something of an experiment. It was adopted after design studies had indicated substantially a standoff between it and a conventional layout with two slow-speed units of larger size. An analysis of the first full year of opera-

By C M STANLEY
Stanley Engineering Co,
Muscatine, Iowa

A small high-speed engine, for light loads and peaks, teams with two larger slow-speed machines in modern 700-hp station designed with "big-plant" attention to engineering details

tion (1941), as disclosed by the superintendent's records, permits a more accurate appraisal of the merits of the design, and a comparison of investments and operating costs.

The investment in the two 200-kw units and the one 75-kw unit (exclusive of building, switchgear, wiring, engineering and overhead) is approximately $50,500. To obtain substantially the same dependable capacity (275 kw) it is probable that a 250-kw and a 300-kw unit would have been selected in order to coincide with standard ratings. It is estimated that this would have required an investment of about $57,000. This indicates a gross difference of $6,500 in generating-equipment investment or a net advantage of at least $5000 in favor of the 3-unit layout after making allowance for an additional switchboard panel and wiring.

Operating Records

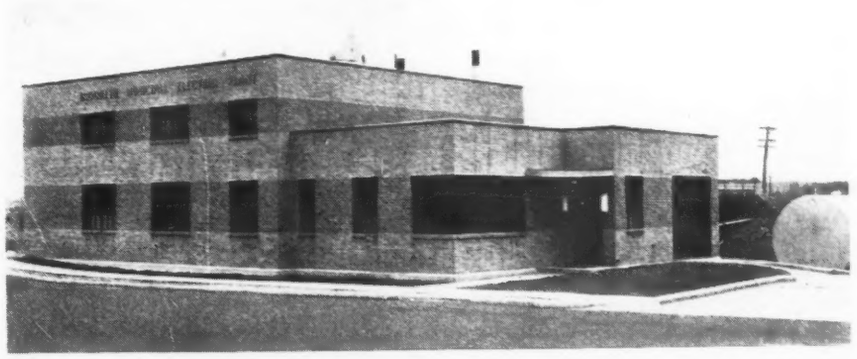
Generation and fuel and lube-oil consumption for 1941 are shown in Table 1. Had a plant with a 250-kw and a 300-kw unit been required to carry this same load, and had the running hours been divided equally between the two units, the fuel consumption would have been at least 85,000 gal. The fuel saving therefore distinctly favors the 3-unit plant.

A plant with a 250-kw and a 300-kw unit, each operated half of the time, would have totaled 3,600,000 rated hphr. At 3000 rated hphr per gal the plant would have consumed 1200 gal of lubricating oil. Thus, an advantage is also indicated on lubricating oil.

So far as maintenance is concerned, the records of one year are inadequate for drawing conclusions. The original design studies (based on manufacturers' data) indicated that the 3-unit arrangement (with high-speed unit) would have maintenance costs about $200 per year in excess of the 2-unit low-speed plant. This, however, is an unproven estimate.

Summarizing this discussion, the use of a small "light-load" unit appears to offer savings in investment, and in fuel and lubricating-oil costs, which will more than offset higher maintenance costs. These gains may be partially offset by the inconvenience of an extra unit in the plant and the hazard of local changes which may curtail its usefulness. Every plant is, of course, a problem in itself—but at Brooklyn the arrangement seems to be one that is workable, and satisfactory based on more than a year's operation.

Except for a few features, the auxiliaries and control of the plant are conventional. In general, all the auxiliary equipment is located in the basement



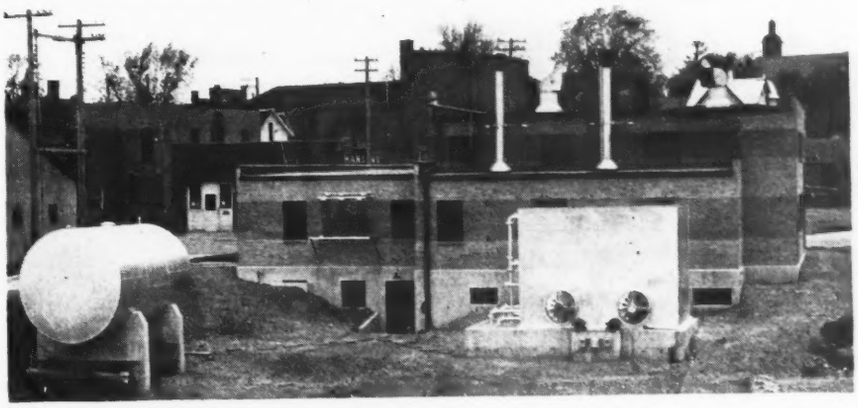


Fig. 2, 3—Front and rear views show modern streamlined architectural design of power station and location of oil-storage tank and cooling tower

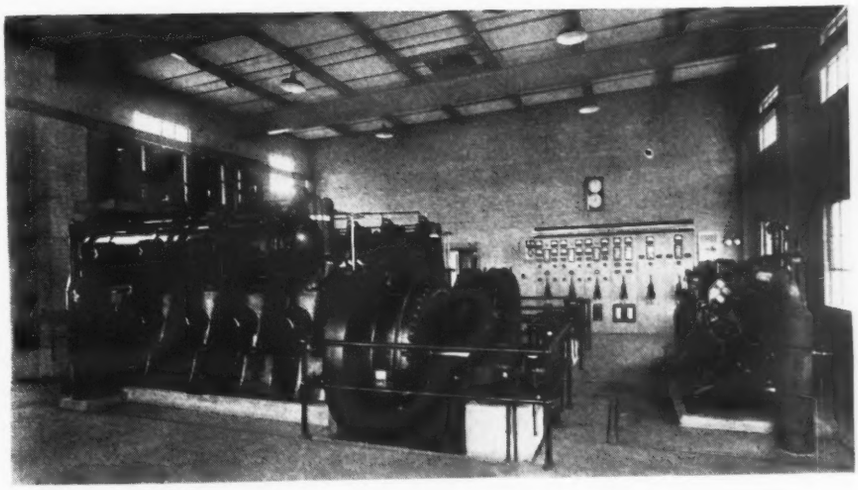


Fig. 4—Two large engines, "light-load" unit and switchgear in main engine room

along the back of the plant, Fig. 1. Each engine is provided with an air filter and an exhaust silencer. The fuel-oil system includes an unloading stand and pump, fuel-oil storage tanks, transfer pump and day tanks. The lubricating system is arranged for batch purification with the necessary tanks and transfer pumps. Starting is by compressed air stored in two tanks kept up to pressure by a motor-driven compressor, with a gasoline-engine standby drive. The cooling-water system is closed, with jackets, raw-water pumps and a cooling tower. A water softener is provided for makeup.

Electrical Gear

The electrical apparatus includes a 6-panel switchboard controlling the three generators, the station-service feeder and two outgoing feeders. The "blond" color, flush-mounted instruments and fluorescent lighting of the switch gear combine to catch the eye. As will be seen from Fig. 1, 4, the switchgear is arranged so that the panels are flush with the engine-room wall and the bus structure is located behind, accessible from the hallway. Thus, ample space is provided around the rear of the switchboard and the bus structure, Fig. 5. The switchboard itself is finished in a light gray color which is set off by the black trim on the instruments and apparatus on the board. Flush-mounted instruments are used and the entire board is lighted by a fluorescent canopy light. The result is not only a board of striking appearance, but one which incorporates definite features of safety and accessibility.

One of the most successful details of the plant is the alarm and control panel, in the engine room. On this panel are located a pyrometer, a 2-pen recording thermometer for keeping a graphic record of the cooling-water temperature, and pushbutton controls for the water pumps, cooling-tower fans, and fuel- and lubricating-oil transfer pumps. The panel also has gages for jacket water, cooling water and air pressure, and it mounts the alarm relays and indicating light for the plant alarm circuits. The arrangement of the panel is similar to the switchgear, with access to the back of the panel from the garage. The panel is also "blond" finished and has a fluorescent canopy light which affords glareless illumination.

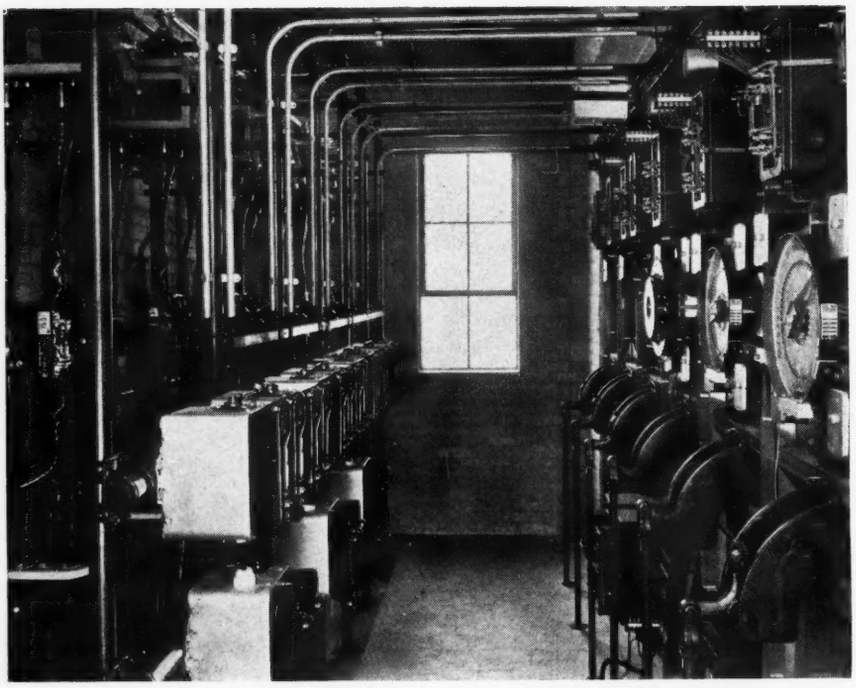


Fig. 5—Switchgear and bus structure are accessible from rear

As previously mentioned, the cooling system is closed, jacket-water pumps circulating the water through the engines to heat exchangers in cooling-tower base. The raw-water pumps take the water from the tower sump and force it over the spray. This part of the system is entirely conventional. However, a forced-draft rather than an atmospheric tower is provided. It is divided into two compartments, each of which has a fan controlled from the plant control panel. This arrangement provides positive cooling under all atmospheric conditions and results in a structure that is neat and clean. Ability to operate either or both of the cooling-water pumps and either or both of the tower fans permits considerable flexibility.

Waste-Heat Recovery

Two different waste-heat systems warm the plant. The first system consists of forced air circulation through compartments built around the engine exhaust silencers, the heated air being returned to the engine room. The second consists of a number of unit heaters and one radiator (in the office) supplied with warm water from the engine cooling system. Arrangements are made so these heaters are in parallel with the cooling tower and in extremely cold weather and at light loads the engines are cooled by these unit heaters.

TABLE I—Generation, Fuel and Lube-Oil Consumption

Unit	Rating, kw	Hours operated	Generation, kwhr	Fuel Consumption gal	Fuel Consumption kwhr/gal	Capacity factor
1	75	2353	126,300	11,685	10.8	0.71
2	200	3339	368,400	30,845	11.9	0.55
3	200	3356	369,400	30,970	11.9	0.55
Total....		9048	864,100	73,500	11.75 (Avg)	

Unit	Rating, hp	Hours operated	Rated hphr	Lube-oil consumption gal	Lube-oil consumption rated hphr/gal
1	105	2353	247,000	264	935
2	300	3339	1,001,000	358	2798
3	300	3356	1,007,000	318	3166
Total....		9048	2,255,000	940	2400 (Avg)

Provision of adequate meters for maintaining proper records forms an important feature. The input and output of each engine can be determined by means of individual fuel-oil meters and watthour meters. In addition, the total plant input and output can be determined from a master oil meter and a totalizing watthour meter on the switchboard, which also has a recording wattmeter and a recording voltmeter. Each of the outgoing feeders and the station service is provided with a watthour meter. A 2-pen recording thermometer on the cooling-water system provides a 24-hour graphic record of the cooling-water temperatures maintained. Lubricating-oil is also metered so that accurate records may be kept on each unit.

The Brooklyn Municipal Electric Plant was placed in operation in December, 1940, approximately a year after the citizens of Brooklyn had voted for its establishment. In addition to the construction of the generating plant, the project involved the purchase of the distribution system from the utility which formerly served Brooklyn and some rehabilitation and repair work on this system. The project was carried out under the direction of the Town Council of Brooklyn, C E Brooks, Mayor. The plant is under the supervision of a Board of Trustees, of which C C Ecklund is chairman. G H Keedy is plant superintendent.

The project was designed and its construction supervised by the Stanley Engineering Company under the direction of the writer; Maynard Dix was resident engineer.

Principal Power Equipment

Brooklyn, Iowa
Stanley Engrg Co—Consulting Engrs

Generating Equipment:

Engines, 2, two-cycle mechanical-injection....Fairbanks, Morse & Co
300-hp, 4-cylinder 14x17-in. 300-rpm units driving 200-kw 250-kva 3-phase 60-cycle 2400-volt Fairbanks, Morse & Co generators, with chain-driven exciters
Engine, 1, 4-cycle mechanical-injection.....Caterpillar Tractor Co
105-hp 6-cylinder vertical 5 ¾x8-in. 900-rpm "light-load" unit driving 75-kw 93.8-kva 3-phase 60-cycle 2400-volt General Electric generator with direct-connected exciter
Governors .....Woodward Governor Co
Starting-air compressor.....Ingersoll-Rand Co
Starting-air-compressor motor.....Fairbanks, Morse & Co
Starting-air-compressor engine.....Wisconsin Engine Co
Exhaust silencers.....Burgess Battery Co
Air filters.....American Air Filter Co
Pyrometers .....Brown Instrument Co

Cooling System:

Cooling tower.....Diesel Service Co
Cooling-water pumps.....Fairbanks, Morse & Co
Water softener.....Refinite Corp

Fuel and Lube-Oil Systems:

Oil-storage tank.....Morrison Bros Co
Transfer pumps.....Fairbanks, Morse & Co
Oil purifier.....Diesel Service Co
Meters .....Pittsburgh Meter Co

Electrical Equipment:

Switchgear.....Electrical Engineering & Construction Co
Meters, regulators, breakers.....General Electric Co
Control panel.....Electrical Engineering & Construction Co
Station transformers.....General Electric Co

Contractors:

Building .....L E McCorkle
Diesel-generating units.....Fairbanks, Morse & Co
Diesel-generating unit (75-kw).....Martin-Roasa Tractor & Equip Co
Switchgear and wiring.....Electrical Engineering & Construction Co
Distribution changes.....L E Kepp Contracting Co

✦ ✦ ✦

Advise BIC of Movement of Scrap Material

The industrial salvage section of the Bureau of Industrial Conservation is distributing report blanks (see copy at right), printed in the form of self-addressed post cards, setting forth the movement and disposal of scrap materials. The blanks are being distributed by the regional offices of the BIC and it is hoped that they will eventually be placed in the hands of the salvage managers of all American manufacturers. At the bottom of the card are spaces for three companies, designated *A*, *B* and *C*. Write in these spaces the firms to which scrap material was sold, or disposed of in some way. Then in the column marked "Key," place an *A*, *B* or *C*, indicating which company got which material.

BIC expects the reports to give some measure of the progress of its industrial salvage program. Further, the cards should provide a definite check on what industries and what committees in BIC's Industrial Centers Organizations are keeping accurate data on their salvage efforts. The Bureau is appealing to all salvage managers to fill out and return the cards as soon as possible. They may be obtained by addressing the Bureau of Industrial Conservation, War Production Board, Washington, D. C.

MAIL AS SOON AS DISPOSITION IS MADE

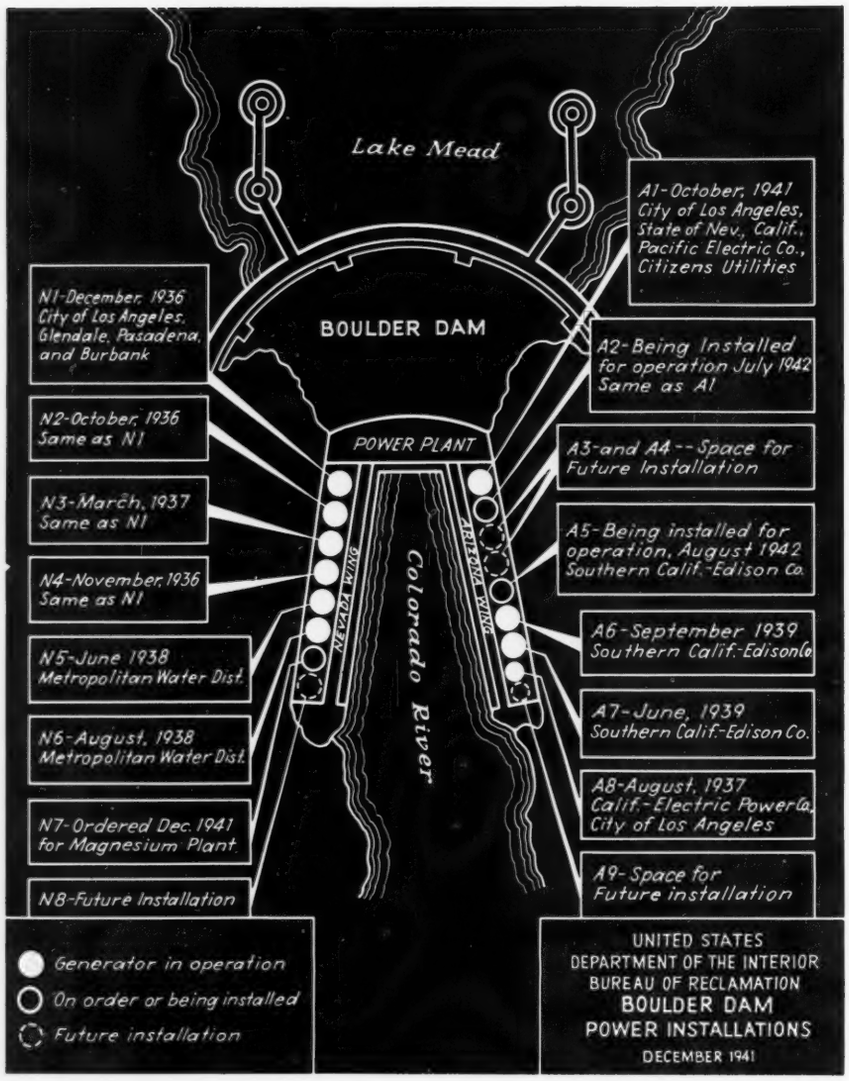
(Company reporting)

(Address)

(Salvage manager or person reporting)

DATE		KEY	16-27820-1
Iron and Steel			lb.
Nonferrous Copper, Brass, Aluminum, etc.			lb.
			lb.
			lb.
Rubber			lb.
Other Paper, Rags, etc.			lb.
			lb.
Sold To—	A		
	B		
	C		

1,327,000 Hp At Boulder Dam


Lake Mead
BOULDER DAM
POWER PLANT
NEVADA WING
ARIZONA WING
Colorado River
N1-December, 1936 City of Los Angeles, Glendale, Pasadena, and Burbank
N2-October, 1936 Same as N1
N3-March, 1937 Same as N1
N4-November, 1936 Same as N1
N5-June 1938 Metropolitan Water Dist.
N6-August, 1938 Metropolitan Water Dist.
N7-Ordered Dec. 1941 for Magnesium Plant
N8-Future Installation
A1-October, 1941 City of Los Angeles, State of Nev., Calif., Pacific Electric Co., Citizens Utilities
A2-Being Installed for operation July 1942 Same as A1
A3-and A4--Space for Future Installation
A5-Being installed for operation, August 1942 Southern Calif.-Edison Co.
A6-September 1939 Southern Calif.-Edison Co.
A7-June, 1939 Southern Calif.-Edison Co.
A8-August, 1937 Calif.-Electric Power Co., City of Los Angeles
A9-Space for Future installation
Generator in operation
On order or being installed
Future installation
UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BOULDER DAM
POWER INSTALLATIONS
DECEMBER 1941

▶ BOULDER DAM WATER AND POWER PROJECT is approaching its final stage of completion. When the contract was let for its construction, March, 1931, no one could foresee that in 10 years, nearly 1,500,000 hp of power-generating capacity would be installed or on order for its power plant and that it would generate 3,224,423,000 kwhr in 1941. On this page the diagram shows the present status of power-unit installation and the cities and companies served by these units.

Boulder Dam has many unique features. It is 730 ft high from the lowest point on its bed-rock foundation to its crest, almost 200 ft higher than any other dam in the world. It is 650 ft thick at its base, measured up and down stream. With a crest length of 1180 ft it contains 3,400,000 cu ft of concrete. This is a greater volume of material than in the great pyramid of Cheops in Egypt that held the record for 3000 years.

This dam also forms the largest artificial reservoir in the world, now known as Lake Mead. When filled to the top of the spillway gates it will store more than 31,000,000 acre-ft of water. When it is realized that most of the world's reservoirs have a capacity of 500,000 acre-ft or less we get some idea of the size of Lake Mead.

To build the dam the river was diverted around the site through four concrete-lined tunnels 50 ft in diameter. Since the tunnels were closed in February, 1935, to fill the reservoir, the river has been under complete control. In June of that year nearly 4,000,000 acre-ft of water was stored back of the dam. If this water had gone down the river uncontrolled it would have caused destructive floods. Later in the year, river flow dropped to 5000 sec-ft above the dam, which would have resulted in a serious irrigation water shortage. Because of the water stored during the June flood a flow of 10,000 sec-ft was maintained below the dam, the amount needed to meet irrigation requirements.

It required the total flow of the river for seven years, less that needed for irrigation and power generation, to fill the reservoir. Water flowed over the spillway for the first time on August 6, 1941. Since then water level in the reservoir has been gradually drawn down for power generation and through the bypass valves in preparation for control of this year's flood. Before Boulder Dam was built the river flow below its site varied from as low as 1200 sec-ft to as much as 250,000 sec-ft with an annual flow of 17,500,000 acre-ft. During the heaviest recent flood, which occurred in 1938, over 9,000,000 acre-ft of water was stored in Lake Mead in about four months and nearly 2,000,000 passed through the plant.

Boulder Dam plant, as can be seen in the diagram, is laid out for 15 large units and two small ones. The large ones are rated 115,000 hp and the small ones 55,000 hp under a 520-ft head. These with two 3500-hp service units give the plant an ultimate capacity of 1,835,000 hp. The first large unit went into service in October, 1936 and by August of this year eleven large ones, one small one and the two service units will be in operation, totalling 1,327,000 hp, with one main unit on order. Thus, in eleven years Boulder Dam plant has grown to become the largest single power installation in the world, practically all of which is going into the power systems of southern California.

Two other plants are being built below Boulder Dam. Davis Dam, 67 miles below, will back the water up to the tail-water of Boulder and will form a storage reservoir of 1,800,000 acre-ft. The power house will have five 62,200-hp units to operate under a 140-ft head, a total capacity of 311,000 hp. Present plans call for starting work on the project this summer.

Eighty miles below Davis Dam is Parker Dam power house, with four 40,000-hp units, a total of 160,000 hp, for 85-ft head. The reservoir formed by this dam is the intake for the Metropolitan Water District of Southern California, the water system that serves Los Angeles and other cities.

WARTIME POWER CLINIC

Practical ways to create emergency capacity. Cures for overloads, breakdowns, short-handed staffs, lack of spare parts, etc. Contributions invited at regular rates

Have You An Answer?

Here are a few of the many questions thousands of power engineers must answer in the near future:

How can I convert my steam-generating plant from one fuel to another?

How can I store more fuel to protect against possible delivery difficulties this fall or winter?

What effect will the conversion of a factory to war work have on its power plant and power services?

How can I replace the lad who was drafted?

What's the best way to break in a green hand in a hurry?

If you have worked-out practical solutions for these or similar emergency problems, let's have them. Clear sketches or photographs will help get your point over. All material published will be paid for.

PHIL SWAIN

Bearings and Metal Melting

THE FOLLOWING COMMENTS are based on the Clinic questions and suggestions in February POWER, of which the most important related to bearings. I have found that bronze or babbitt sleeve bearings may be used on shafts turning up to 2500 rpm. On shafts running faster than 2500, I have replaced worn ball bearings with homemade roller bearings. Ball bearings are too difficult for homemade construction, but that does not apply to roller bearings. I take drill rod of suitable size and turn up a shell of a good grade of cold-rolled steel. Next step is to temper the drill rod and case-harden the shell with cyanide. Such bearings last a long time.

It is easy to reclaim old metal by building a small pot out of plastic refractory. This may be fired by an oil burner, gas or coal blast and will melt bronze very easily. If the bronze becomes too soft in remelting, the cause is the disappearance of zinc through oxidation. With the aid of some molding sand, the user can make billets, or he may make his own patterns, and with a little practice, his own castings.

The average cost of melting in a small tank runs from 20 to 30 cents per lb.

Warren, Pa. R E OSGOOD

Two 4-Cylinder Magnetos Fire 8-Cylinder Engine

WE OPERATE SEVEN 400-hp gas engines driving generators for an oil-producing property. These are "straight eight" 4-cycle units with magneto ignition.

War shut off possible replacements of our foreign-built 8-cylinder magnetos, so when one of them went out of commission we replaced it with two American-made 4-cylinder magnetos coupled as shown. Results have been highly satisfactory.

Magneto 1, a "right-hand" unit, was mounted on the plate of the replaced magneto, Fig. 1, and driven in the same direction by the original sprocket and chain. Placed end to end with right-hand Magneto 1, Magneto 2 must be a "left-hand" unit. It was mounted on a 3 x 3-in. angle bolted to the engine. To connect the two, one end of a 3-in. long, $\frac{5}{8}$-in. diameter shaft was turned down to $\frac{3}{8}$ in., threaded and screwed in a drilled and threaded hole in the sprocket shaft, as shown in Fig. 2. To admit this stub shaft to the sprocket casing a $\frac{3}{4}$-in. hole was drilled in the cover plate. Oil seals were applied.

In a connection of this sort the direction of the thread (left or right hand) should be such that the stub shaft won't unscrew in operation. If the threads are cut by tap and die, the stub shaft is likely to run out of true. This may be cured by making the stub shaft oversize, screwing it in place, setting the assembly in a lathe to run concentric with the sprocket shaft, then turning the coupling end of the stub shaft true to size and true with the sprocket shaft.

The electrical details are easily handled if the principles of magneto operation are understood. These should be clear from the sketches. Note that the cranks of an 8-cylinder, "in-line" engine are 90 deg apart, with two cranks in each of the four directions.

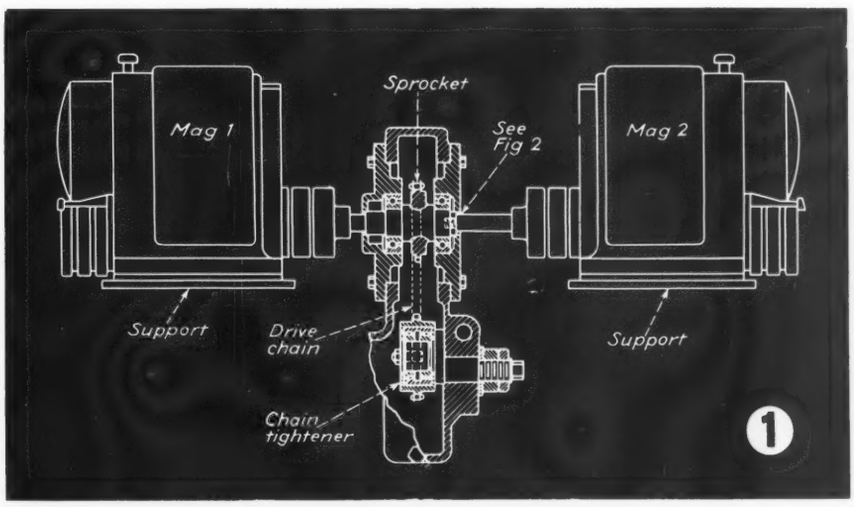


Fig. 1—Magneto 1 sits in position of original 8-cyl magneto. Facing 4-cyl magneto is connected to the other unit by a stub shaft

In a 4-stroke-cycle engine, such as this, it takes four strokes, or two revolutions, to complete a cycle of operations, regardless of the number of cylinders. Each piston fires every other revolution. Thus of any two pistons that go up and down together, one fires on one revolution and the other fires on the other. The firing order of this particular engine is 1-5-2-6-8-4-7-3, as shown by the 2-revolution diagram, Fig. 3.

As far as firing is concerned, note that pistons 1-2-8-7 act as one 4-cylinder engine and pistons 5-6-4-3 act as another 4-cylinder engine with cranks offset 90 deg from the first. It is therefore clear that one 4-cylinder magneto could fire the first set of four cylinders and another the other set.

Because each 4-cylinder bank requires two sparks per revolution, and a magneto produces two sparks per revolution of its armature, the magneto must be geared to the engine one-to-one. However the distributor in the magneto is geared to make one turn for each two turns of the engine because the distributor points must cover the operations of a complete cycle.

Thus Fig. 4, 5 and 6 represent distributors turning at half engine speed. In each case 90 deg represents 180 deg of crank rotation, and 45 deg represents 90 deg of crank rotation.

On this basis, Fig. 4 is the distributor of the original 8-cylinder magneto, firing in the order 1-5-2-6-8-4-7-3. Note that this can be replaced by the two fours set as shown in Fig. 4 and 5. These are 45 deg apart on the distributors or 90 deg apart on the armature shafts.

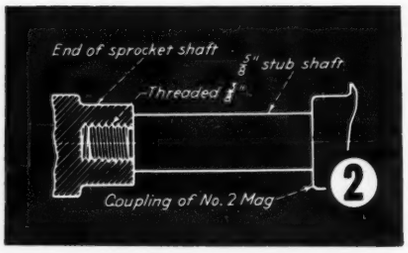


Fig. 2—Detail of stub shaft

The whole electrical scheme is more clearly shown by Fig. 7 in which the clock hands represent the contact arms of the two distributors, moving in unison. This movement will fire the cylinders in the order 1-5-2-6-8-4-7-3.

All cylinders should fire about 22 deg ahead of upper dead center. After the magnetos are solidly coupled together at the correct relative angle the chain-sprocket drive is adjusted to fire at this angle of advance.

When planning this particular job we considered using two right-hand magnetos instead of one right and one left. This idea was discarded because it would involve complicated gearing to make both run in the same direction.

The arrangement described has worked with complete success. Credit for its installation must be shared with L G Coop, chief plant engineer.

J T McKinley
Levi Ackley Oil Co
Hardin City, Oklahoma

Emergency Repair Keeps Old-Time Engine Running

A ONE-CYLINDER NON-CONDENSING steam engine, running at 65 rpm, and installed sixty years ago, still drives 75% of our factory production machinery through line shafting. In 1882 the engine was the town's prize exhibit, but the builders have long since gone out of business.

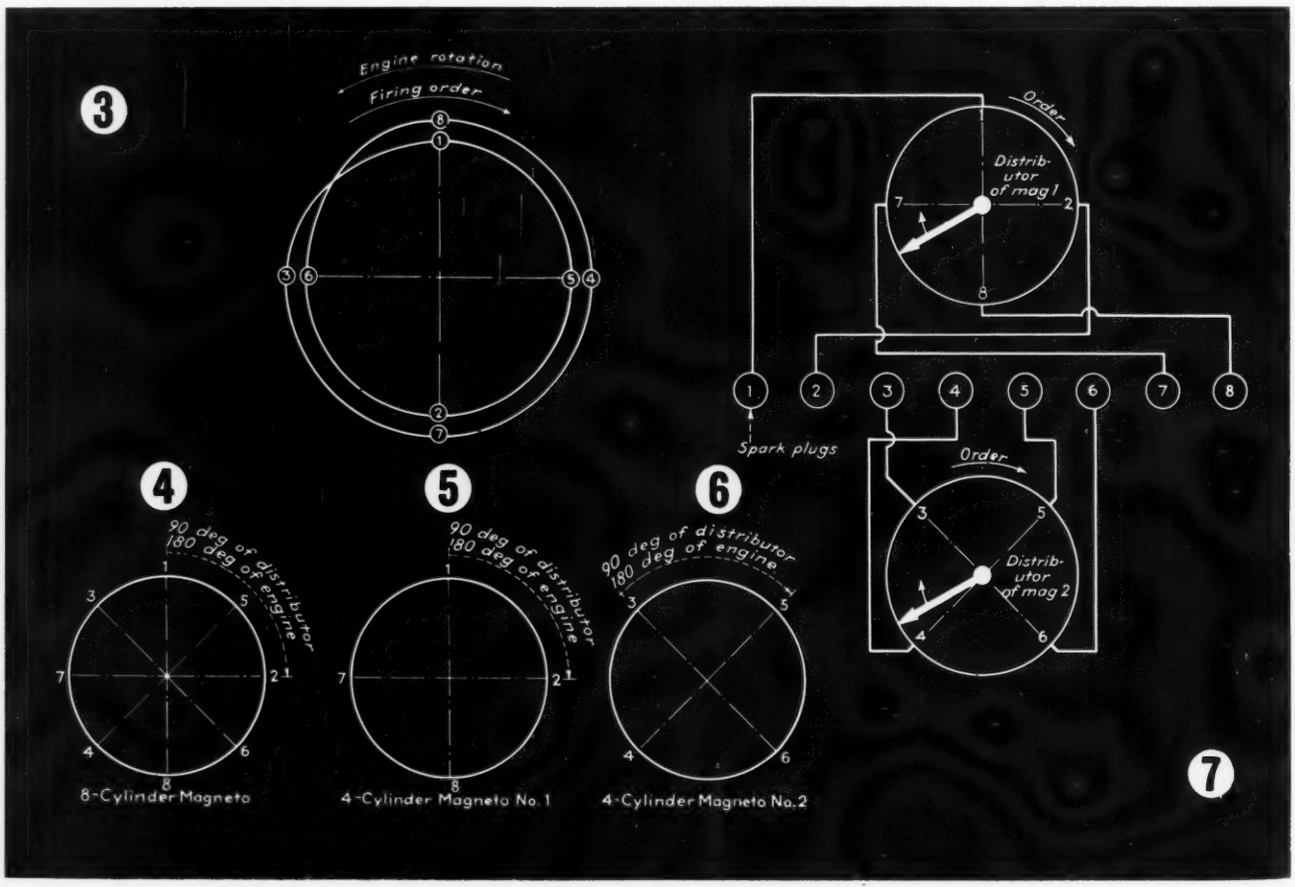


Fig. 3 Two revolutions complete a cycle. Firing order of this engine is 1-5-2-6-8-4-7-3 Fig. 4—Magneto distributor turns once while engine shaft turns twice, so the 45-degree angle from 1 to 5 on this 8-cylinder distributor represents a quarter turn of engine shaft Fig. 5 & 6—These 4-cylinder magnetos coupled with distributors offset 45 deg as shown, are exactly equivalent to the 8-cylinder distributor of Fig. 4 Fig. 7—Electrical diagram of complete two-magneto setup

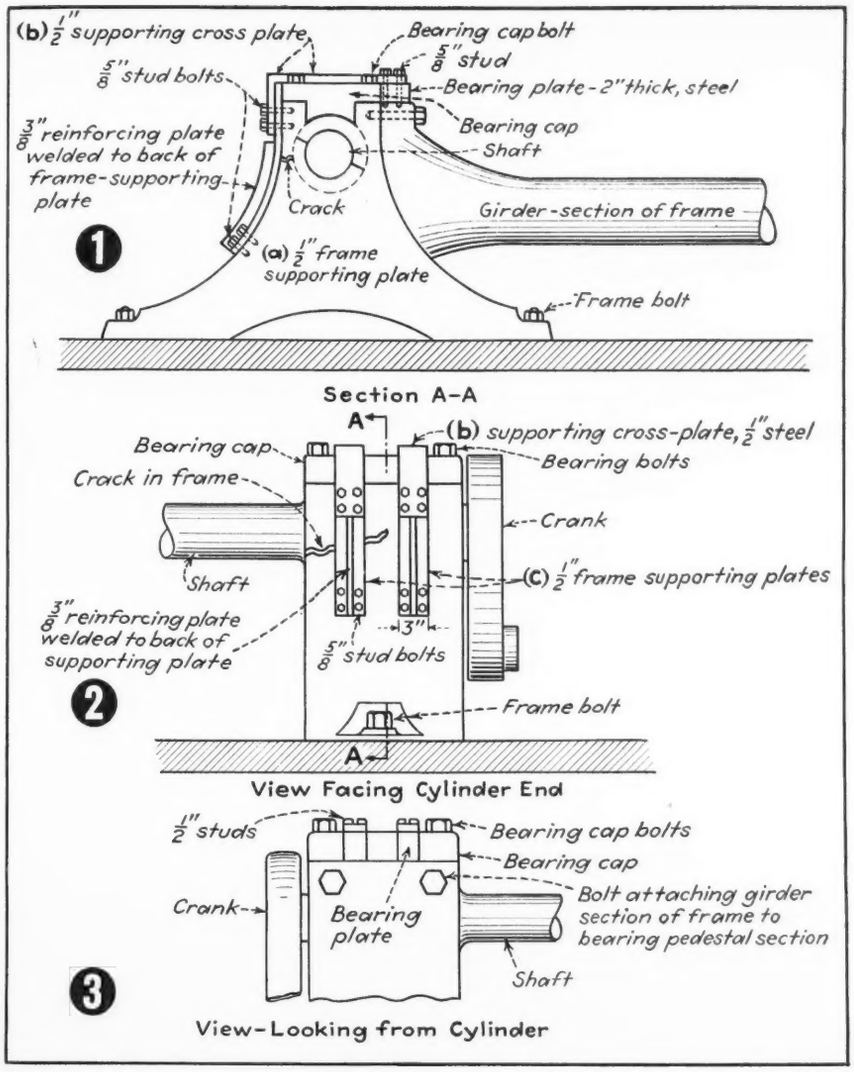


Fig. 1, 2 and 3 Bolted straps repaired bearing pedestal of 60-year-old engine

A short time ago the old engine developed a heavy knock and inspection revealed a crack in the rear section of the frame pedestal at the bearing housing (see drawings).

According to the watch engineer the knock developed suddenly, but he could find no defects on immediate inspection and kept the engine running rather than interrupt production in the plant. In a way it is a miracle that the engine did not wreck itself, as the nature of the crack and its location permitted an appreciable movement of the bearing at each stroke reversal.

Probably the construction saved the day. The frame is in three parts: rear bearing pedestal section, girder or center section and cylinder housing. The three are connected by heavy bolts. This construction provided a certain amount of rigidity, despite the failure of the rear part of the bearing housing section.

Nevertheless, we were in a very serious predicament. The frame section was enormous, and it was out of the question to cast another in the allowable time, to say nothing of the inaccuracies that would result. It was clear that welding or brazing would not be satisfactory for a crack of this sort, so I proceeded to design, construct and install a repair based on interlocking heavy iron and steel scrap.

Two steel plates (a) one-half inch thick, three inches wide and 20 inches long, were fitted to the contour of the rear bearing pedestal frame. These, in turn, were reinforced by $\frac{3}{8}$-in. plate welded behind them on the curves. The frames were drilled and tapped and the plates bolted to the frame by $\frac{5}{8}$-in. stud bolts as shown.

The bearing crossover plate (b) are likewise of $\frac{1}{2}$-in. steel, and overlap the vertical reinforcing plate as shown, greatly increasing the strength of the repair. The opposite ends of the crossover plate are bolted to the girder section of the engine frame through spacer bars, using other $\frac{5}{8}$-in. stud bolts as shown.

We made this repair in our own shop with material in stock. The engine was turning the lineshaft at full rated power twelve hours after we discovered the crack. Despite its emergency nature, this repair has proved highly satisfactory and no movement in the shaft can be detected under load.

Meanwhile the management has made plans to install a 300-hp synchronous motor to replace the engine, but its installation may be delayed many weeks or months because of the war.

Although this repair may be peculiar in its type, I feel that it may serve as an inspiration to other engineers who must keep 'em rolling under wartime conditions.

Cleveland, Ohio A R CIOTTI

Emergency Bearings—Including Wood

THE ENGINEER CAN BEST FACE today's problems of substitute bearings if he goes back to first principles. Direction of pressure is the first consideration. In a *journal* bearing, Fig. 1, page 94, the pressure is perpendicular to the shaft. In a *pivot* bearing, Fig. 2, the pressure is carried on the end of the shaft. When pressure is parallel to the axis of the shaft, and the shaft continues through the bearing, Fig. 3, it is a *collar* bearing. Fig. 4 shows another type of collar bearing.

The *area* of a bearing is customarily measured in terms of the projected area in the direction of pressure. Thus, in Fig. 1 the projected area is the diameter of the shaft times bearing length. In Fig. 2 it is the cross-sectional area of the shaft. In Fig. 3 it is the area of a circle having the same diameter as the collar minus the cross-sectional area of the shaft. In Fig. 4 the bearing area of one collar is figured as in Fig. 3, and this is multiplied by the number of collars.

Lubrication is better with a fluctuating load, because the lubricant then has a better chance to work in between the shaft and the bearing. Pressure on a lubricated journal bearing is not uniform around the circumference, but varies from a maximum near the point where the line of action of the load cuts the surface to zero at point 90 deg from this—that is, at the point where the bearing is usually divided. The pressure on a bearing is greatest at the middle of its length.

Large bearings are usually lined with "white metal." This is used not only for its anti-friction qualities, but also for its ability to accommodate itself to the journal better than rigid

metal. A bearing lined with rigid metal will rapidly heat up and wear, whereas a soft white-metal lining will yield where the pressure is greatest until the journal bears uniformly on the supporting surface.

For a first-class babbitting job with a large bearing the casting should be preheated and the white metal hammered in after it has hardened. The bearing is then bored out to the exact size. For small and less-important bearings the hammering and boring may be omitted.

Fig. 5 shows a bearing with the step constructed entirely of white metal, the white metal extending the whole length of the bearing. For large bearings some engineers recommend that the white metal be fitted in separate strips, Fig. 6, each strip being fitted and driven in like a key.

As a substitute for metals I would suggest hard wood. Following are the principle woods used in machine construction, with some of their qualities:

ASH—Straight grained, tough and elastic. Resistant to sudden shock. Very durable if protected from the weather.

BEECH—Very compact grain. Takes a smooth surface.

BOXWOOD—Bright yellow color. Very hard and heavy and takes a smooth surface. Is used for sheaves of pulley blocks, bearings, small rollers, etc.

ELM—Valuable because of its durability when constantly wet.

FIR and PINE—Cheap and easy to work.

LIGNUM-VITAE—A very hard and heavy wood—one and one-third times as heavy as water. Very valuable for underwater bearings. Also used for sheaves of pulley blocks and for other purposes where great strength and hardness are required.

MAHOGANY — Durable, strong, straight grained. Less liable to crack or twist in seasoning than almost any other wood.

OAK — Very strong. Tough and straight grained, and durable either wet or dry. Suitable for bearings. English oak is considered the best.

TEAK—Very strong, durable and tough. Minimum shrinkage in seasoning. Wood contains natural oil.

Bearings in expensive machinery should preferably be metal, of course. High-speed bearings should be carefully lubricated. In the author's experience operators are often very careless in lubricating equipment, oiling as convenient and using any oil that may be in the can.

Fairview, N. J. MARTIN GOZDENOVICH

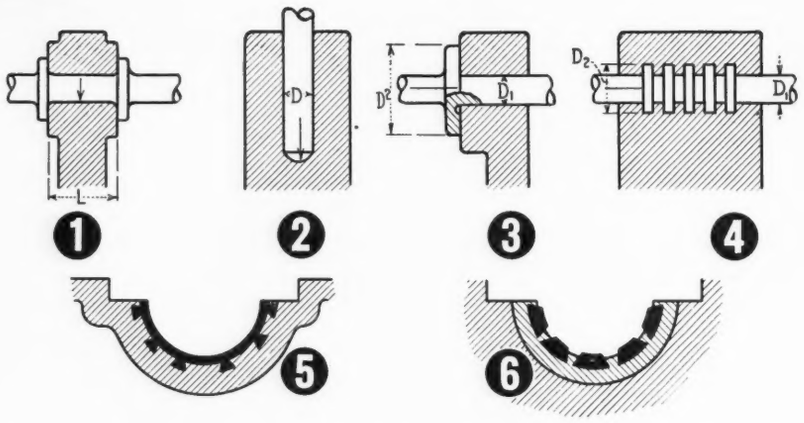


Fig. 1—Journal bearing. Fig. 2—Pivot bearing. Fig. 3 and 4—Collar bearings. Fig. 5—Full babbitted bearing. Fig. 6—Bearing with inserted strips of babbitt

"Secondhand" Babbitt

THOSE OF US who find it hard to get new babbitt metal can profitably turn to "scrap." Some of this metal comes from high-class machinery and is good for almost any purpose. Some is low grade, but there are many places in most industrial plants where low-grade babbitt is satisfactory. Then, too, it can be improved by blending with a higher grade metal.

The used metal should be tested by breaking and checking the fracture and by cutting the pieces with a knife. Otherwise some zinc or useless metal will be passed. From my experience zinc will not mix with lead or babbitt metal to make a satisfactory bearing.

Thirty years ago sleeve bearings for motors up to even 40 hp at 1800 rpm were made of a die-cast metal containing zinc and aluminum. It seemed to me that these bearings were very satisfactory for the purpose. We have used some in this way because we cannot secure brass. The metal is hard and the bearing should be well fitted and not tight.

Another bearing material that might be used more in some places is wood, such as hard maple. There are a number of firms making different types. Hard maple has been used on agricultural machinery for years. Treated bushings can be bought or made for loose pulleys, etc, and pressed in the same way as a brass bushing. This is satisfactory where the bushing is thick enough to hold the fit.

These bearings will run without oil for years, and will outlast metal bushings, save oil and not score. We have some loose pulleys made of several pieces of maple bolted together, bored and turned. They are more satisfactory than the original.

Many small brass bushings on gas or diesel engines could be replaced by case-hardened steel bushings and case-hardened pins. When well made and fitted these will outlast the brass bushings.

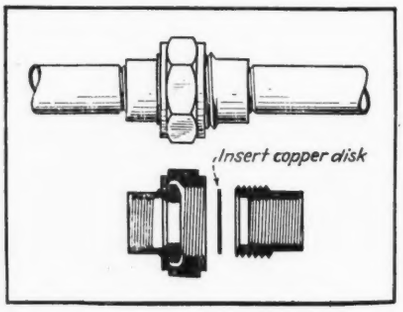
Sayre, Oklahoma G M HARDY

Isolating a Branch Line

IT SOMETIMES HAPPENS (and will more often as the war goes on) that a repair must be made on a branch steam, water or air line where there is no branch cutoff valve. To shut the main down long enough to make the repair would generally involve a serious interruption of service to other equipment served by the same main. On the other hand, if the branch line has a union, it will sometimes be possible to shut off the main for a minute without any appreciable injury to product or serious interruption of production.

It can be isolated by simply shutting the main-line valve, opening the union in the branch line, inserting a soft metal disk (generally copper), closing the union and then opening the main-line valve. For a speedy operation carefully fit the disk to a similar union in advance and get tools and helpers lined up for fast work without a slip.

Englewood, N. J. R BOETTINGER



Procedure: (1) Shut off main-line valve; (2) open union; (3) insert disk; (4) close union, turn on main-line valve

POWER for POWDER

By MAJOR WAYNE O HAUCK
U. S. Ordnance Dept

▶ DEVELOPING, MANUFACTURING and procuring war materials for the U. S. Army—including rifles, antitank guns, cannon, fire-control instruments, tanks, explosives, etc (1200 major items)—is the job of the U. S. Ordnance Department. Building of many plants for the manufacture of combat equipment, a multi-billion dollar program, is now almost complete.

Explosives form a large sector of this program, and typical of these is a smokeless powder plant that covers several thousand acres and contains 685 buildings with a combined floor space of 2,500,000 sq ft.

This gigantic powder plant came into being six weeks ahead of schedule. All kinds of smokeless powder are made here, from rifle powder to large cannon powder. The cannon powder is moved to huge bag loading plants.

To indicate the immensity of this project I might state here that it includes 67½ miles of standard-gage railroad track, 50 miles of roads and 186 miles of service piping, including steam, water, brine, hydraulic, fire and process.

Water, power and waste disposal are the three principal services required in the manufacture of smokeless powder. Highly inflammable throughout the various stages of manufacture, the nitrocellulose must be submerged in water at all times. Washing out the impurities with more water constitutes a large part of the process.

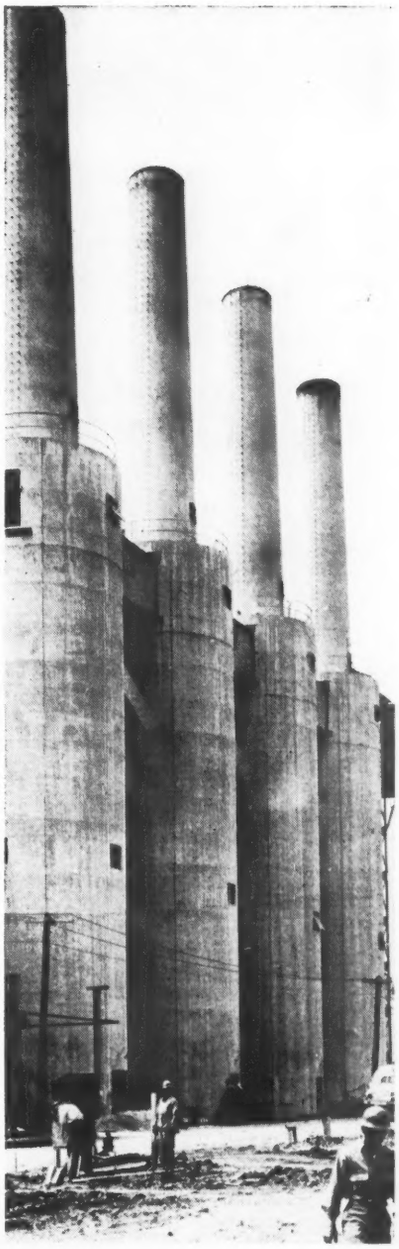
Progressive straight-line production is utilized, the plant being divided into a number of widely separated parallel manufacturing units, each complete from raw material to finished product. The two main divisions of the plant are known as the Nitrocellulose Area and the Smokeless Powder Area respectively.

To insure continuous operation the power plant was designed in two separate units some distance apart. A power distribution line connecting the two is looped about the works. Automatic cut-ins are provided to restore service to units left without power in case of failure of either of the power houses. The water system is similarly divided.

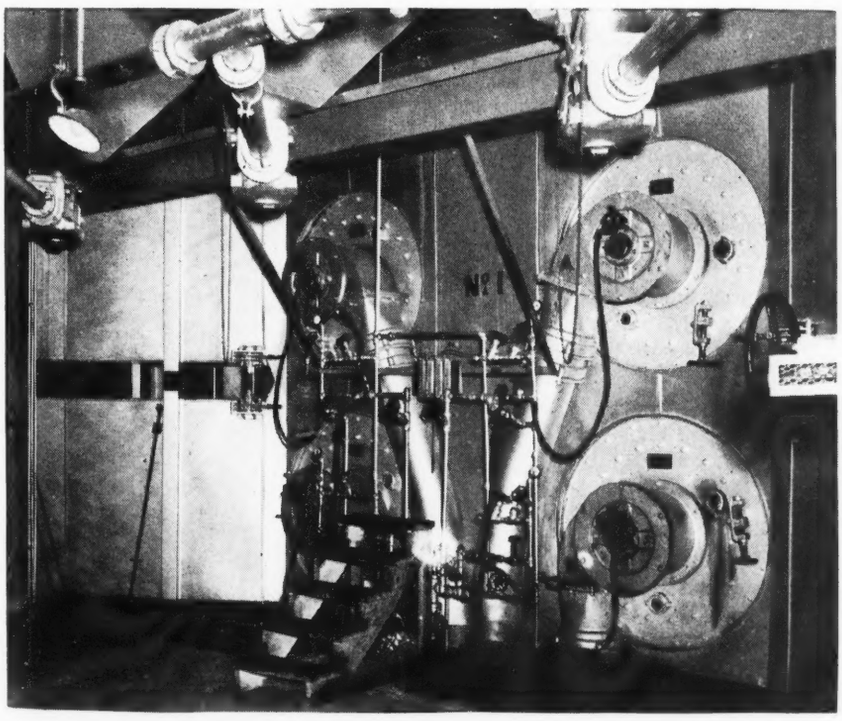
Power units consist of Combustion Engineering boilers and Westinghouse turbo generators. Electrical loads range up to 40,000 kw. Steam is supplied at 550 psi and 700 F. Turbines bleed to process at 150 and 5 psi. Reducing valves are cut into the main steam boiler (550 psi) to extract steam at 300 and 10 psi.

The 4-drum watertube boilers have water-walled dry-bottom furnaces. Each is fired by four pulverized-coal burners. Oil is used for starting and ignition.

Coal is obtained from Southern Indiana mines with analysis showing ash



Lower halves of stacks are coal silos



Each boiler is fired by four pulverized-coal burners. Oil is used for starting

CONTINUED ON PAGE 98

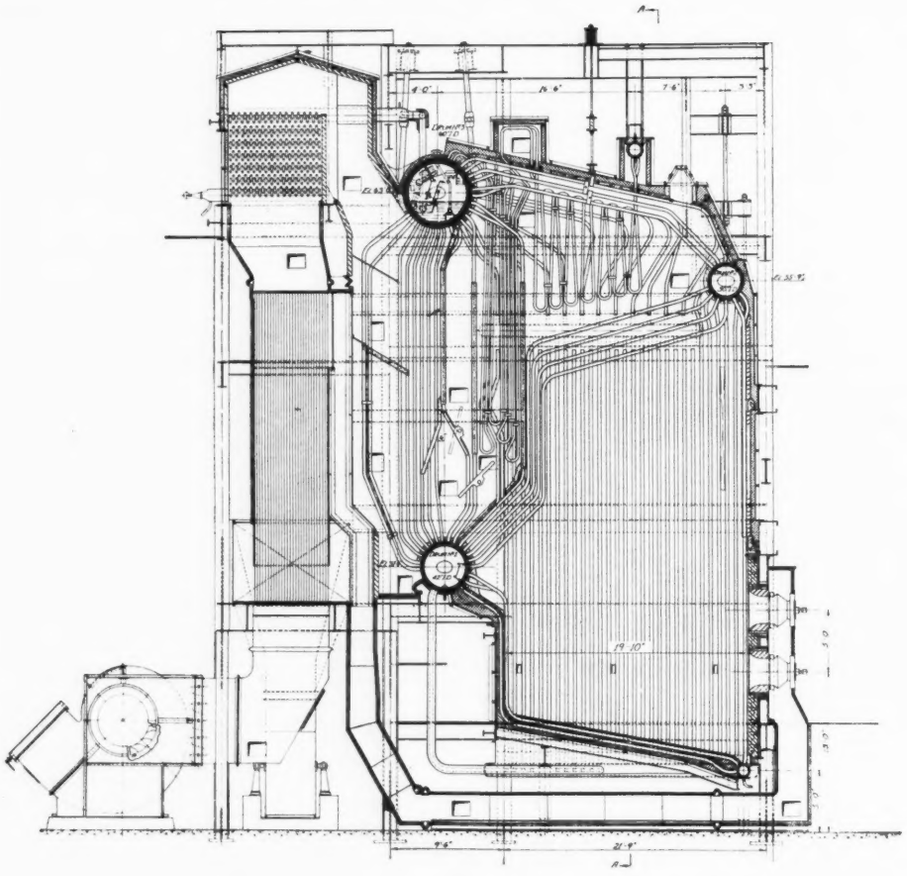
In the past two years

One Company ordered eleven Riley Units

What better proof could be presented to indicate the satisfactory performance of Riley Steam Generating Units than the following record of orders received from one large company covering Riley Steam Generating Units having a total capacity of over 3,000,000 pounds of steam per hour.

Riley has climbed to a position of leadership in the boiler and fuel burning industry because Riley design and workmanship assure absolute dependability and outstanding results—because of the plus values in Riley equipment.

Mar. 1940	3—300,000 lbs./hr. Gas and Oil Fired Units—	500 lbs.— 750°F.
Sept. 1940	2— 65,000 lbs./hr. Pulver Coal Fired Units—	475 lbs.— 750°F.
Dec. 1940	1—300,000 lbs./hr. Gas and Oil Fired Unit—	500 lbs.— 750°F.
Feb. 1941	1—300,000 lbs./hr. Gas and Oil Fired Unit—	500 lbs.— 750°F.
Dec. 1941	2—450,000 lbs./hr. Gas and Oil Fired Units—	1425 lbs.— 900°F.
Feb. 1942	2—250,000 lbs./hr. Pulver. Coal Fired Units—	475 lbs.— 750°F.



Two 450,000 lbs./hr. Riley Steam Generating Units
1425 lbs. Pressure—900°F. Steam Temp.
Gas and Oil Fired

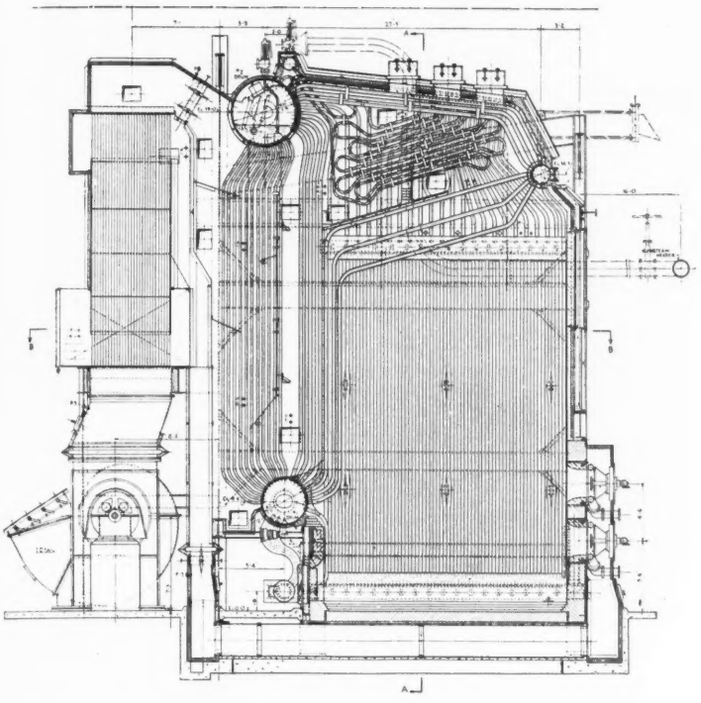
RILEY

STOKER CORPORATION, WORCESTER, MASS

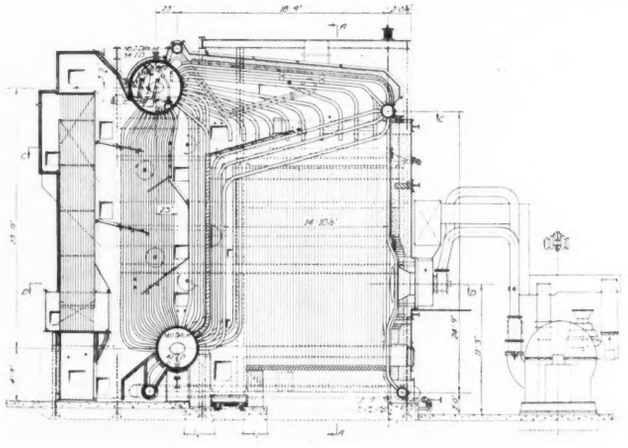
Boston New York Philadelphia Pittsburgh Baltimore Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis Richmond

It will pay you to visit modern Riley Installations

producing 3,030,000 lbs. of steam per hour



Five 300,000 lbs./hr. Riley Steam Generating Units
500 lbs. Pressure—750°F. Temperature
Gas and Oil Fired



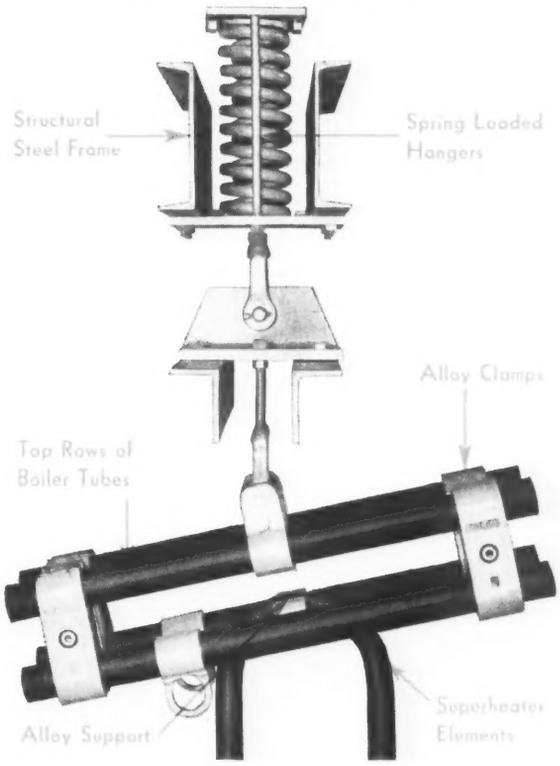
Two 65,000 lbs./hr. Riley Steam Generating Units
475 lbs. Pressure—750°F. Temperature
Pulverized Coal Fired. One unit also fired with wood refuse

Distinctive Features

of

RILEY STEAM GENERATING UNITS

Superheater Supports



With large high temperature superheaters, it is desirable to support the superheater elements from outside the setting to prevent any possibility of sagging under service. Riley Superheater elements are supported from the structural steel frame outside the setting by spring loaded hangers and rugged alloy clamps as illustrated above.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • AIR HEATERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • FLUE GAS SCRUBBERS

before purchasing Boiler or Fuel Burning Equipment

CONTINUED FROM PAGE 95

around 11%, volatile 41%, fixed carbon 47%, and sulphur 4%.

Heat values range from 12,000 to 12,700 Btu per lb "as received." Brought in on hopper-bottom cars and dumped into bins, the coal can be moved to stockpiles or directly to the silos.

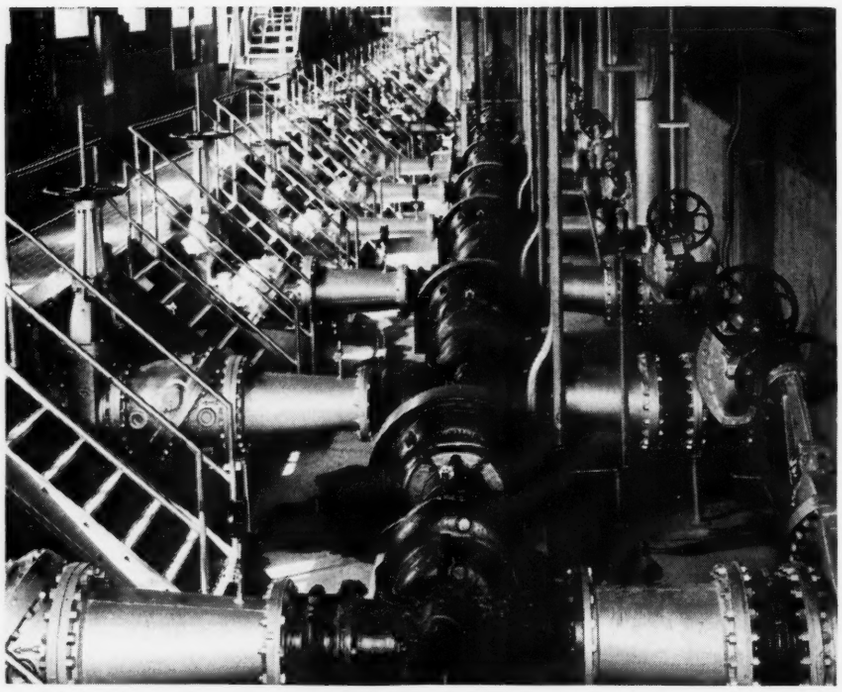
The lower 90 ft of the furnace chimneys serve as coal silos, filled from the stockpiles by belt conveyors. These silos feed coal continuously by gravity to the pulverizing mills, two to each furnace.

Ashes are conveyed by water jets and sluices to a clinker grinder, then delivered by an ash pump to a disposal basin some distance away. Flyash drawn from the bottom of the hopper is discharged into the clinker grinder system.

The generators are 5000-kw 11,500-volt 60-cycle units operating at 3600 rpm with closed ventilating systems. Electric power drives pumps, air compressors, wringers, Jordan engines, blowers, hydraulic presses, conveyors, agitators and refrigeration plants.

Electricity and Water

In electrical-power transmission, current at 11,600 volts is sent in a loop from each of the two power houses to the manufacturing portion of the plant served by each power house. The 2300-volt loops serve small groups of buildings after transformer substations step down the voltage. Individual transformers yield 110 to 440 volts as desired at stations serving one or two buildings.

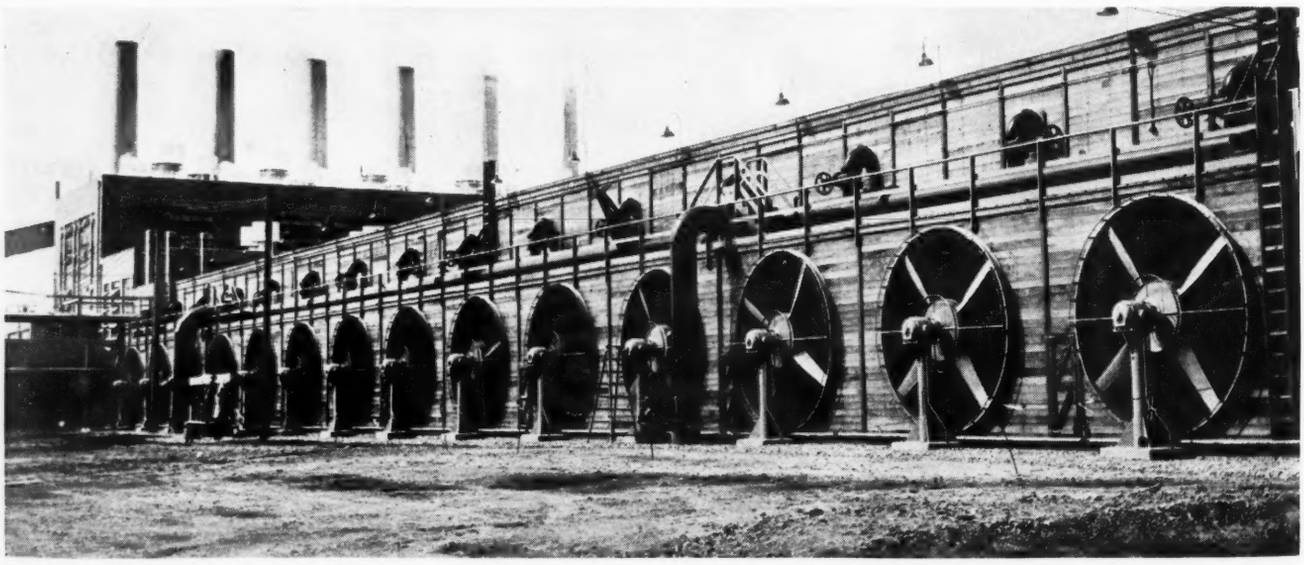


Pump room serves the entire plant. Total water use is greater than that of Louisville

Outstanding among the facilities of this great plant is the large quantity of water used—more than the entire consumption of the city of Louisville. To obtain water as pure as possible, and to eliminate the need for a filtration plant, the wells were sunk through approximately 90 ft of sand and gravel. The Ranney water collector system employed consists of 13-ft steel-and-concrete caissons with perforated steel pipes radiating in all directions from the bottoms. Each caisson has 1400 ft of 8-in. collector pipe. The wells are equipped with a number of 3500-gpm pumps located at the bottom. Water is stored in two huge reservoirs, one at each power house.

The area contains 175 miles of piping, exclusive of that within the buildings. At each reservoir is a pump house containing nine reservoir pumps for service water; nine cooling-tower pumps; nine condenser pumps and six fire pumps.

Two Foster-Wheeler fan-ventilated towers cool the condenser water. All valves for control of the flow of water through the mains and headers are operated hydraulically from controls. The cone valves used have proven very efficient in cutting flow uniformly and in eliminating water hammer.



Twenty-eight fans circulate air through cooling tower for condenser water. Plant turbines produce up to 40,000 kw

MORE POWER FROM EXISTING EQUIPMENT—5

Practical suggestions for increasing capacity quickly and with minimum use of strategic materials

MORE PRODUCTION WITH LESS KILOWATTS

By E W FELLER
Assistant Editor

The quickest and least costly way to add plant capacity is to eliminate power wastes wherever they occur—every kilowatt cut from peak load is a kilowatt of extra capacity for the top production days ahead. And every kilowatt-hour saved means a pound of coal or more cut from the railroads' heavy burden. Here's the blueprint for a practical power-saving program for your plant

▶ INCREASING CAPACITY by eliminating power wastes offers a real answer to today's problems because, since little or no new equipment is required, there is no waiting for deliveries and gains can be realized immediately. Keeping power consumption at a minimum starts with the familiar but highly important job of maintenance. This requires practically nothing in the way of hard-to-get equipment or strategic materials —just concentrated application of the simple rules every good operator knows. The next step involves metering to stop wasteful use of electricity. Some equipment and investment may be required but it is small in relation to the savings that can be made. The last step requires a study of motor applications and of electrical-system conditions to reduce power consumption and improve power factor. Here also some plant changes may be involved but the possible gains far outweigh the cost involved. This special section covers each of these basic steps in turn and so represents a complete blueprint for a timely practical power-saving program.

In the average plant, putting maximum emphasis on good operation and maintenance will pay the biggest immediate dividends in power saving. Poor maintenance breeds conditions that cause power losses: leaks through faulty insulation, friction losses resulting from worn bearings, tight belts, and misaligned shafts, leaks in water and air lines that mean waste of pump and compressor power. The fact that one plant reduced its power load over 100 kw by properly insulating the distribution system alone and that in another improved operation reduced power consumption 30% from what it was with careless operation, shows what can be done along these lines.

The first step in reducing power waste is to keep the equipment scrupulously clean and properly lubricated. This in itself will do a big job. For example, when the air gap of an induction motor fills with dirt or its bearings wear so that the rotor rubs the stator core, power is being wasted to overcome excess friction in the motor. A poorly lubricated belt conveyor, with dirt and material piled up around its rollers, may take 50% more power to drive it than one properly maintained.

Keep oil off belts and keep belts in good condition so that they can drive their loads with a minimum of tension. Increased tension means more bearing wear and friction, and thus more power consumption. On short-center drives mount the motors on a pivoted or automatic tension base, as this permits operating with minimum belt tension.

Keeping lineshafts and other equipment in good alignment, locating bearings along the shafts at points of maximum loads, using proper lubricants and anti-friction bearings, selecting a proper method of speed adjustment where it is required, and attention to other features of good practice in transmitting power from the motor to the driven machine will help to reduce power consumption. In one plant two 100-kw motor-generators were required to supply power to a group of machines and cranes that

were poorly maintained. When these were put in good working condition and kept that way, one mg set had ample capacity to supply the load.

Leaks in water lines and in water-using equipment are obvious causes of large power losses. Losses in compressed-air systems may be greater because less noticeable. Leaky valves and pistons on compressors waste power in recompression and overheat the compressor, as does operating compressors for long periods unloaded. Whenever belt- or chain-driven compressor operates for a considerable part of the time unloaded, changing the pulley or sprocket ratio to slow down the compressor will reduce the load on the motor and consequently on the power system, and will cut kilowatt-hour consumption as well.

Pumps must also be maintained in good condition. A pump in which the clearances are so badly worn that it is operating at 50% efficiency, from all outside appearances looks the same as when it was operating at 80% efficiency, but requires 37.5% more power to pump the same quantity of water. Packing that is too tight on the pump shaft increases power consumption. A non-drip stuffing box may look nice on the outside, but on the inside may waste a lot of power.

Long lineshafts driving machines used intermittently usually cause large power losses. A change to individual motor drive, if the motors can be obtained, may reduce the power required to drive the load 50%. If a number of machines operate continuously, a lineshaft or modern group drive may offer savings over individual drive.

Electrical meters intelligently used in combination with a comprehensive system of records are a big help in keeping down power loads. In fact meters rank second to good maintenance and are part of the maintenance tools. The meters used include both portable and permanently installed designs of ammeters, voltmeters, wattmeters, power-factor meters, motor-load analyzers, megohmmeters, tachometers, etc.

Power should be metered to each production department in the plant. Keep records of power to each department and hold the operating head of this department responsible for any unaccountable increases in power consumption. This also applies to water and compressed air if used in considerable quantities. In this way their use and power consumption will be kept at a minimum.

On many machines an occasional load test with portable meters every six months, or when something develops to cast doubt on a machine's performance, may be sufficient. On other machines in which the friction load or other objectionable conditions may increase quickly, a permanently installed indicating ammeter or wattmeter is a good investment and power saver.

Where loading of the driving motor is a matter of machine adjustment in the hands of the operator, an ammeter or wattmeter in the motor circuit will save power by showing the operator when the correct adjustment is made.

Insulation is the vulnerable part of every electrical machine and system. Its quality is affected by heat, moisture, oil, dirt, acid, sulphurous and other fumes, mechanical stresses and other conditions. Even though not normally seriously affecting power consumption, a close check should be kept of insulation condition, easily done with a megohmmeter. These tests should be made periodically and a record kept, from which any weakening of equipment insulation can be located before it causes unexpected shutdowns.

Much has been said about good illumination, but this should be obtained without unnecessary power waste. Install modern efficient lighting units, keep them clean, paint walls of a color favorable to good lighting, arrange the lighting units so that no more than needed at any time will have to be used and if necessary make some one responsible for switching them off when not required.

Where power generating units or transformers are being overloaded on peak periods, this condition can often be relieved by changing operation. Water tanks can be pumped full and kept full during off-peak periods so that pumps can be shut down during the peaks. To a lesser degree the compressed-air system offers similar opportunities. In some cases, it may be desirable to cut off non-essential loads during the peak period.

Where several furnaces or ovens are operated it may be possible to schedule them so that only part of them will be in service at any one time. It is also possible to operate ovens at off-peak periods and thus keep this big block of load off the peak entirely.

In many plants much can be done to reduce power load by selecting motors and controls suited to the applications; using high-speed induction motors with proper speed reducers instead of slow-speed direct connected motors; using modern group drive, where it is suited, instead of small individual motors;

Fig. 1—Frequent insulation-resistance tests form an important part of electrical equipment maintenance. Dust accumulations lower this resistance considerably

using medium and large-size synchronous motors instead of induction motors, where possible; replacement of old and inefficient equipment with modern motors and control of proper size for the load, and by other means.

Power-factor improvement offers a real opportunity to reduce the load on lines, transformers and generators. Four times as much copper is required to transmit a given load at 0.50 power factor as at unity power factor with the same line losses. This is because the line current increases directly as power factor decreases and the line losses increase as the square of the current. Nearly 30% more generator and transformer capacity is required to supply a given load at 0.70 power factor as at 0.90 power factor and 66% more copper will be required in the cables for the same voltage drop.

Extensive use of induction motors and a general tendency to over-motor are among the chief causes of low power factor. In metallurgical plants certain designs of electric furnaces contribute their share to low-power-factor conditions. The introduction of fluorescent lighting has also helped to lower the power factor of industrial-plant loads.

A survey of induction-motor loading would be the starting point in a power-factor-improvement program under normal conditions. In some plants power factor has been considerably improved by interchanging motors on different drives. For example, a 5-hp motor might replace a 10-hp motor, only partly loaded by the machine it has been driving.

Except under favorable conditions, with high-speed motors, the power factor of an induction-motor load will seldom be above 0.80, but it is frequently possible to replace old slow-speed induction motors of low power factor with medium high-speed high-power-factor motors.

Where machines require motors larger than 50 or 75 hp, it may be possible to replace induction motors with synchronous machines. These motors are built in two general types: those designed for unity full-load power factor and those that have 0.80 leading power factor at full load and normal field excitation. The latter are more expensive motors, but when a maximum of power-factor improvement is required they should be selected.

These are not normal times, and even when it is possible to take machines off the line long enough to change motors, it may not be possible to obtain the new equipment. When a motor is overloaded it may be possible to find a larger motor so lightly loaded driving another machine that the overloaded motor can comfortably take care of this application. Then the larger motor can be moved to the heavier load. For this reason, a load survey should be made of all motors and a record kept of the load, so that it can be easily and quickly determined if a motor change can be made to meet an emergency.

Where generator capacity is the bottleneck in the plant and the power factor is low, it may be possible to obtain a used 0.80-power-factor synchronous motor of correct voltage, for connection to the plant busbars, to operate as a synchronous condenser. Such a motor with normal field current will supply to the line a leading kva equal to about 0.8 of its horsepower rating (Fig. 3). That is, if the motor is rated 500 hp, it will, when operated as a synchronous condenser supply $500 \times 0.8 = 400$ leading kva to the power system. How much such a motor would reduce the load on the generators or transformers will depend upon the power factor of the system before the condenser was connected and the size of the load. Fig. 4 shows the power factor at which synchronous motors operate, at different horsepower loads and normal field excitation.

What the new power factor will be can be determined easily by the chart, Fig. 2. The values of kilowatts and reactive kva run from 0 to 1000. For larger values we use a divisor. Assume an average sustained maximum load of 2500 kw at 0.70 power factor, which is $2500 \div 0.70 = 3571$ kva load. Dividing the kilowatt load, 2500, by 5 gives 500 and the motor reactive kva, 400, divided by 5 gives 80. Both these values are within the limits of the chart.

To solve the problem, from 500 on the kilowatt scale run vertically to intersect the 0.70-power-factor diagonal line. Then, run horizontally to the reactive-kva scale and read 510 kva. From this value subtract the motor reactive kva, 80, or $510 - 80 = 430$. Now drop down the reactive kva scale to 430 and project horizontally to intersect the 500-kw line. This intersection gives the power factor of the load after the motor has been added, which is about 0.76. The load is now $2500 \div 0.76 = 3290$ kva, a reduction of $3571 - 3290 = 281$ kva. This is only approximate because the losses in the synchronous motor will increase the load about 25 kw.

As a general rule, it is not advisable to consider operating a unity-power-factor motor as a synchronous con-

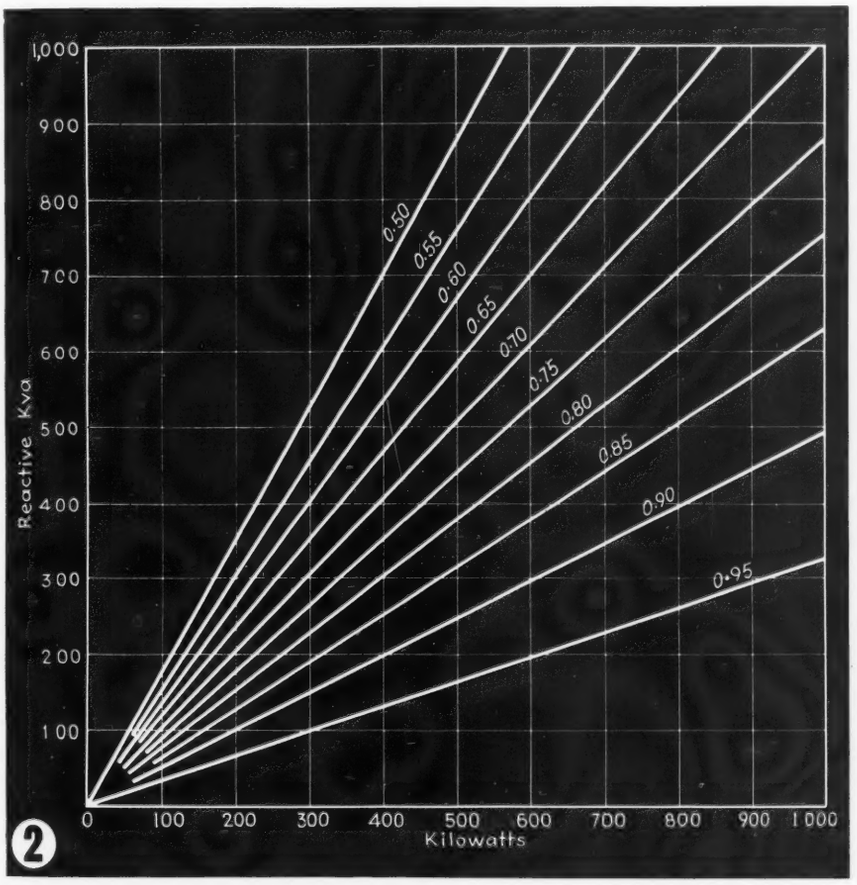


Fig. 2—Simple and useful curve for determining power-factor correction values. Use a common divisor to bring kilowatt and reactive values within curve limits

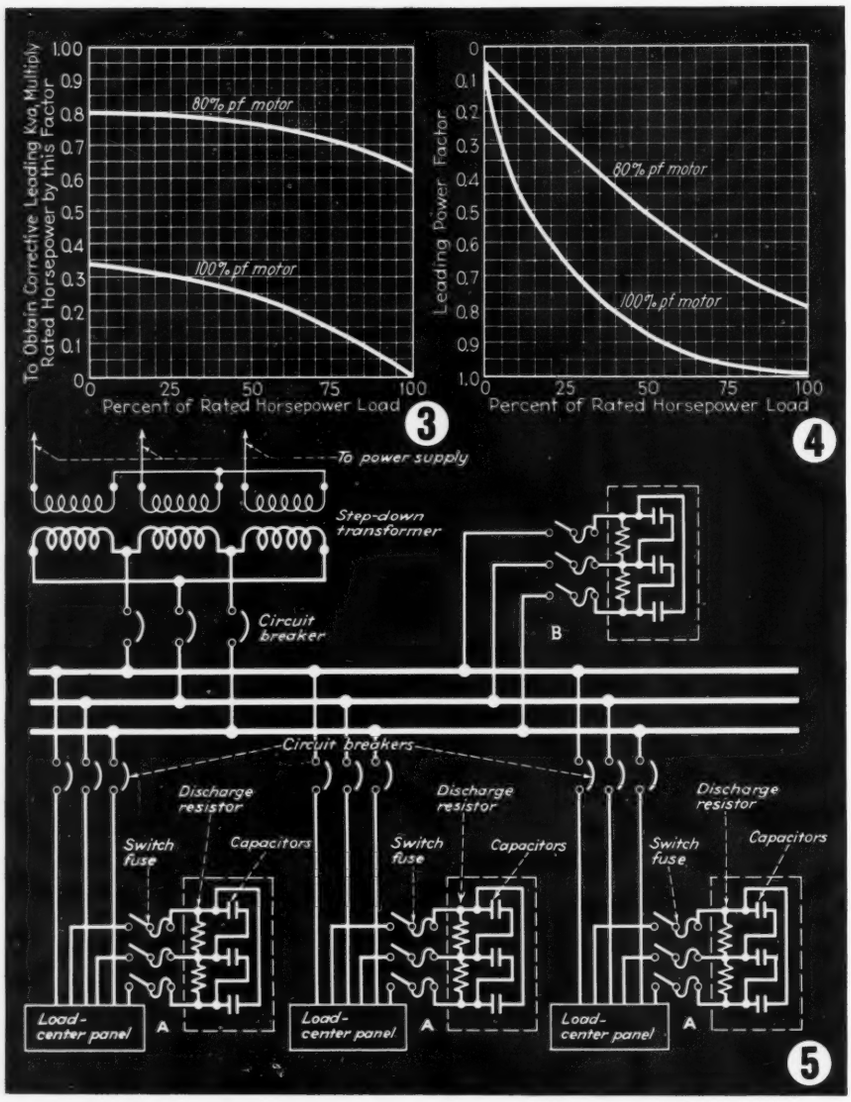


Fig. 3—Synchronous motor furnishes leading reactive to the system in proportion to its mechanical load. Fig. 4—Synchronous-motor power factor varies with mechanical load if field current remains constant. Fig. 5—Capacitors and synchronous motors connected to low-power-factor feeders raise the over-all system power factor. Connected near the load, capacitors reduce feeder current and improve voltage regulation.

denser, unless the motor is available as a spare. Normally, as shown in Fig. 3, such a machine with rated excitation current in the field coils will deliver a leading corrective kva equal to only about 0.33 times the motor's rated horsepower. Increasing the field coil excitation above normal, even where it can be done, will not do much good.

In general, the use of capacitors for power-factor improvement has many advantages over other methods. First, the cost is comparatively low, approximately $7.00 per kva installed. The amount of load reduction is from 0.33 to 0.66 kva per kva of capacitor installed, depending upon the initial power factor. Capacitors are available in small or in large units, to meet the requirements of any size distribution system. This is particularly advantageous in these times when equipment is difficult to get. If only 25% of the needed capacitor necessary to do the job can be obtained it can be installed and the remainder can be added as it becomes available.

On systems where power-factor improvement is needed no equipment will make so much kilowatt capacity available for the use of so little strategic materials as will capacitors. For example, a 200-kva capacitor installed at a load center supplying a 715-kva 0.70-power-factor load, will improve the power factor to 0.85 and reduce the load to 590 kva, a reduction of 125 kva. This capacity has been made available in cables, transformers and generators and the voltage regulation has been improved.

Capacitors may be connected at any convenient point on the system, but they are the most beneficial when connected to load-center distribution busbars, as at *A*, Fig. 5. When connected at these points, capacitors reduce the load on the feeders, circuit breakers, stepdown transformers, and in other parts of the power system back to the power plant. One large capacitor can be located at the substation busbars as at *B*, Fig. 5. Such an installation can be made at lower cost than for the several smaller capacitors on the individual feeders, but it does not reduce the load on the feeders. When only part of the feeders are overloaded capacitors should be installed on these, and if this does not relieve the transformer load sufficiently, then install a capacitor on the substation busbars.

To select a capacitor for a given load we must know the load in kilowatts and its power factor, which should be determined with meters. Assume that the load on an overloaded feeder has been found to be 300 kw at a power factor of 0.68. This represents a kva load on the feeder of $300 \div 0.68 = 440$ kva. If we were to improve the power factor to unity the load would be reduced from 440 kva to 300, a reduction of $440 - 300 = 140$ kva. It seldom pays to correct power factor to more than 0.90 or 0.95. If we correct the power factor to 0.90, the load will then be $300 \div 0.90 = 333$ kva; a load reduction of $440 - 333 = 107$ kva, instead of 140 at unity power factor.

To find the capacitor size to correct power factor to unity, run vertically up the 300-kw line to 0.68 power factor (Fig. 2). Then run horizontally left to intersect the reactive kva line, and read 325 kva. This is the size required to improve the power factor to unity and reduce the load to 300 kw. To find the capacitor size required to improve the power factor to 0.90, start from the intersection of the 300-kw and 0.90-power-factor lines, run left to the reactive kva line and read 150 kva. Then the size of capacitor to improve to 0.90 power factor is $325 - 150 = 175$ kva. By installing a 175-kva capacitor we would reduce the load 107 kva as previously shown. There are very few cases where it would pay to install 150 kva of additional capacitor to reduce the load 33 kva by raising the power factor to unity.

Each plant presents its own possibilities for reducing power consumption and peak loads and each engineer must utilize these to best advantage. However, the foregoing suggestions give a general outline of how and where to attack the problem, and if properly applied will produce large load reductions in many plants; regular inspections will maintain these reductions.

Duplex Pump Control Spells Flexible Operation

Frequently it is more economical to do a pumping job with two or more smaller units than with one large pump. W H Costello, application engineer, Cutler-Hammer, Inc, outlines controls to use with multiple pumping systems and gives the reasons for their selection

▶ WHILE A LARGE PROPORTION of new installations for sump and building service use one pump per tank, it is also common practice to use two smaller pumps for house-pump installation in large buildings and similar installations. The duplex installation permits greater flexibility and economy in operation. For example, the period of maximum demand may not last for more than one hour a day. For 23 hr one pump can keep the tank filled whereas for the other hour both pumps may be required. Obviously the power bills will be less when one smaller pump is used than when a pump double its size is operated. Also, if one unit fails, service can limp along with the other until repairs are made.

When two pumps are used for a house tank or sump, the basic control items for each pump are the same as for a single pump. They include a magnetic starter, a fused safety switch or a circuit breaker, and a 3-way pilot switch. The float switches are also alike, but each is set for a different water level. Float switch No. 1 is set to start and stop pump No. 1 and normally will keep the tank filled. If the water drops below a predetermined level, with only pump No. 1 running, No. 2 float switch will close and start its pump. Both pumps will then continue to operate until normal level is restored.

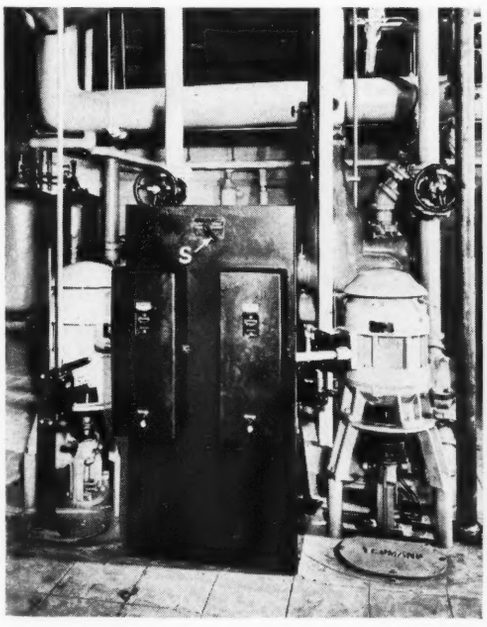
To divide the work between the two pumps a double-throw transfer switch is always part of every duplex installation so that either float switch can control either pump. Fig. 3 shows an elementary diagram of connections for doing this. When the transfer switch is closed to the "up" position No. 1 float switch connects to No. 1 control and No. 2 float switch to No. 2 control. When the transfer switch is in the "down" position No. 1 float switch connects to No. 2 control and No. 2 to No. 1 control.

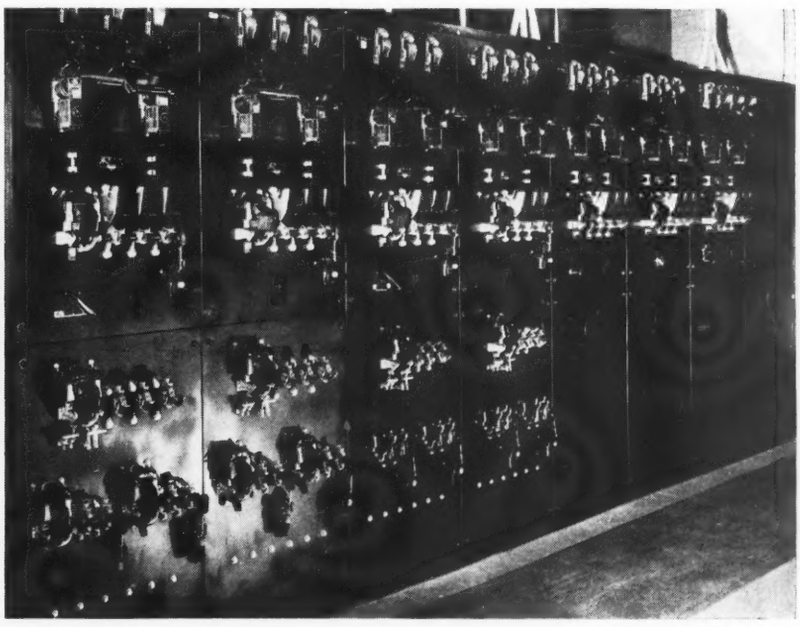
Fig. 1 shows the duplex control to which this diagram applies, which is for a sump-pump installation driven by two 15-hp squirrel-cage motors. In this installation two totally enclosed combination starters with circuit breakers, across-the-line starting contactor and overload relays are mounted with a rear-of-board transfer switch, *S*, at the top of panel. This combination starter uses a circuit breaker operated from the outside of the enclosure instead of a fused safety switch. The pistol-grip rear-of-board-operated selector switch *S*, takes the place of a 4-pole double-throw knife switch and is standard.

Until recently it has been common practice to make a duplex panel from separate pieces of equipment, front-conduit connected on an angle-iron or pipe frame. On the new panels, with the combination starters, conduit connections are in the back, and little work is required to make the connections.

For service-water installations in large buildings several pumps may be operated in parallel or in other combination. These may be extended to take advantage of any improvements in equipment and power supply. Fig. 2 shows a group of seven controllers for

Fig. 1—(Left) Inclosed controls for full-voltage-start 15-hp squirrel-cage motors. Fig. 2—(Right) First four panels from left control four 60-hp wound-rotor motors and the next three are across-the-line starters for 60-hp squirrel-cage motors





house pumps, using 60-hp motors, and is a good example of the conditions outlined. This control panel was enlarged and rearranged at the time the duplex control, Fig. 1, was installed. It includes open switchboard construction; secondary-resistance and across-the-line motor starting; fuses for control wiring; and spare panel and an interesting solution to a transfer-switch problem.

Four control panels at the left. Fig. 2, having contactors on the lower section, are for slipring motors installed about six years ago. The three panels at the right with blank lower sections have been added recently. These new panels are for the same size motors, but use squirrel-cage and across-the-line starting. This method is so simple and generally satisfactory that no other should be used unless the power system will not permit the heavy starting current without excessive voltage drop and light flicker. Whether power is supplied from a private plant or a public utility it is the lighting system which determines the motor-starting method. If the lighting system is tied in with the power supply to the motors, they must be started so as not to cause a noticeable dimming of lights.

Across-the-Line Starting

A squirrel-cage motor starting across the line takes about six times normal full-load current. This may be too much for good voltage regulation and most public utilities have set a limitation on the allowable inrush. However, it is common practice to throw motors up to 15 hp across the line, because manufacturers have developed squirrel-cage motors with special low-inrush characteristics.

In Fig. 2, the four control panels at the left, for 60-hp slipring motors, were installed some years ago in a new addition to a large New York city building which previously had generated its own power. Alternating-current connected load in the new building was so limited at that time that it would not permit the 1000-amp inrush taken by a 60-hp squirrel-cage motor if it was started directly across the line. During the six years between the first and second building addition the ac connected load increased to where the utility company approved across-the-line-starting squirrel cage motors up to 125 hp. Therefore, the three new pumps were equipped with this type of motor and starting method.

Of several methods of keeping down starting inrush, the use of slipring motors with external resistance is the most effective, but also one of the most expensive. Fig. 4 shows a simplified diagram for a slipring motor. This motor is started by first closing the stator switch and then cutting the resistance out of the rotor circuit by closing contactors 1, 2, 3 and 4. In the rotor circuit the magnetic accelerating contactors are automatically closed by timing relays. The starters, Fig. 2, have four starting steps, and with these steps it is possible to keep the current inrush from the line below 150% of motor full-load rating. Torque produced by these motors is approximately equal to inrush current, an inrush of 150% producing 150% full-load torque.

It usually is possible to satisfy all requirements of reduced-voltage starting by using simple squirrel-cage motors with starting resistance in the line, Fig. 5. This resistance can be cut out automatically in one or more steps, by timing relays, depending upon the size of the motor and the inrush increments allowed. Motor torque with primary-resistor starting is lower than with

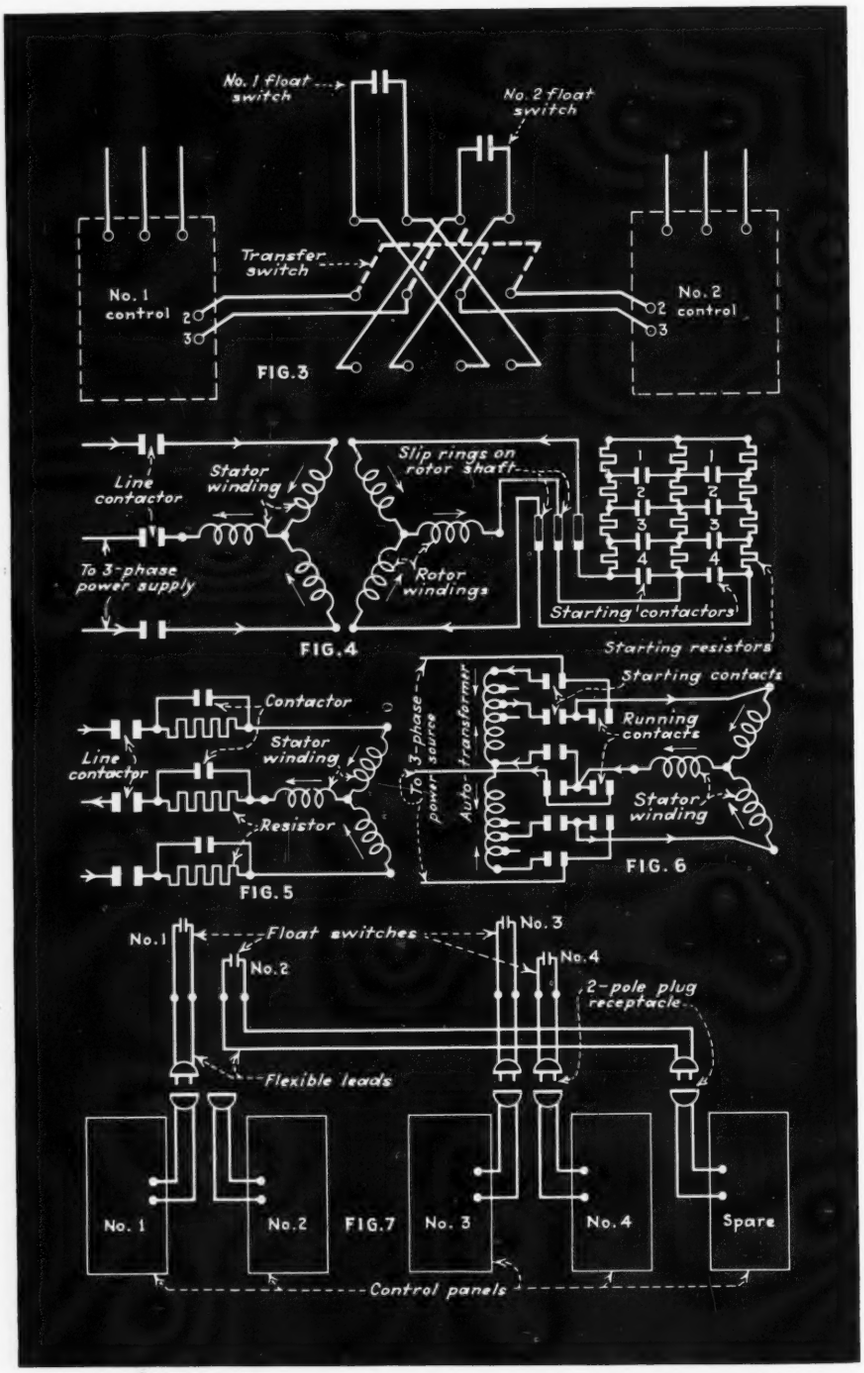


Fig. 3—Simplified diagram of transfer switch on two float switches controlling pump motors. Fig. 4—Wound-rotor induction motor and starting resistance. Fig. 5—Squirrel-cage motor with primary-resistance starting. Fig. 6—Squirrel-cage motor with auto-transformer starting. Fig. 7—Plug-type connector on flexible leads permits connecting spare pump control to any one of four float switches

some of the other starting methods because motor torque drops off as the inrush current squared. This characteristic is not serious in a pump drive, because centrifugal pump load does not start to increase very rapidly until after about 70% normal speed. For these conditions a primary-resistor starter usually satisfies both the utility and the pump starting-torque requirements. An auto-transformer starter, or compensator as it is often called, Fig. 6, is more satisfactory than primary-resistance starting from a torque standpoint, but interrupts the power to the motor when changing from reduced-voltage starting to full-voltage running.

Both sides of the control circuits, including the contactor coil and the wiring from the panel to the float switches on the panels, Fig. 2, are protected by fuses. Control fuses can be considered as an optional feature which may or may not be supplied as a part of the starter panel. These house panels were made especially for this installation, and control fuses were specified. There are about 700 ft of control wiring to be protected, and because the main circuit breaker is rated 400 amp it does not give any protection to this wiring.

Line Protection

Many standard starters are sold without any provisions for line protection in many applications where control fuses are necessary. Responsibility for proper fusing is up to the wiring contractor, who is familiar with the rules and regulations of the National Code which limit the length of control wiring that can be run without fusing.

No control-wiring fuses were included in the connection of the starters for the sump pump, Fig. 1. Combination starters on that panel are standard and do not include control fuses. The length of control wiring from the panel to the float switches is about 6 ft. Circuit breakers used for motor-circuit protection have only 100-amp capacity, and give a measure of short-circuit protection to the control wiring.

One of the three new panels shown at the right, Fig. 2, is a spare unit intended to be substituted for any one of four pumps. The spare unit is complete, including the pump and motor-control panel. Manual operation of the spare is the simplest method, but requires the attention of an operator until the regular unit is repaired. Frequently a transfer switch is provided so that the float switch on any tank can be transferred to operation of the spare unit. As a general rule, when there are three or more units involved the only practical and safe way to satisfy all the requirements of a transfer switch is by a plug and receptacle method, Fig. 7, as was done in the case of the installation shown in Fig. 2. Not only does this arrangement meet all the requirements of a transfer switch but it is simple and inexpensive.

Fig. 8—Standard unit controllers in a cubicle for pump-motor control in a sewage-disposal plant are accessible from both the front and back for maintenance

From the diagram shown in Fig. 7 it is evident that the wiring to any of the four float switches can be transferred from one panel to the spare. The figure shows float switch No. 2 transferred from panel No. 2 to the spare panel. Then with the motor disconnect switch open on panel No. 2 this panel and its motor are entirely dead, and may be worked on with complete safety to the operator. Likewise, fuse protection for the float-switch wiring is also maintained; that is, control fuses on the spare panel take the place of those on panel No. 2.

For two panels only, as in Fig. 1, a 4-pole double-throw switch will satisfy all the conditions required for a safe transfer switch. However, where three or more panels are involved, there is nothing comparable to a double-throw switch that will satisfy all the requirements for a transfer switch. While it would be possible to make up a special switch it would be too complex and expensive. In practice, the plug-in panel is small and compact, the flexible leads short and both the plug and receptacle standard heavy-duty 2-pole devices.

Ordinarily, controllers must be enclosed. Open-type controllers for the house pumps, Fig. 2, were allowed because this installation is in a special pump room under the care of a skilled attendant. Open panels were used to simplify combining the seven panels in one assembly and to take care of the incoming power lines.

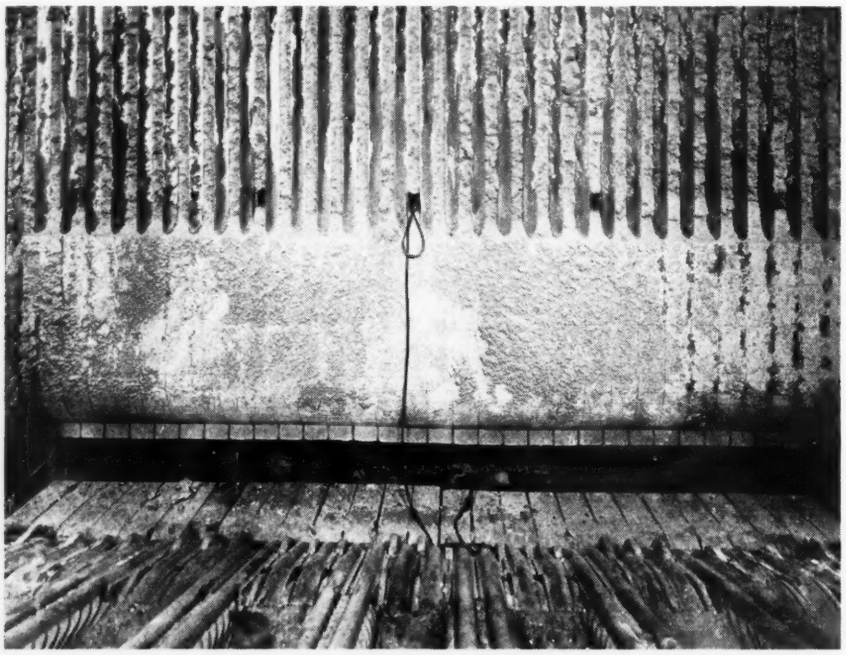
Where it is required to provide enclosures for a controller of this size, it is necessary to use cubicle construction. A cubicle is a special enclosure which includes the horizontal busbar work for the incoming lines, and is so laid out that all parts are accessible from both front and rear. Cubicles likewise include disconnect means for each motor panel. This is necessary for 2200-volt installations where safety to workmen is essential. Ordinarily cubicles are laid out specially for each installation.

For moderate-size units in low-tension construction (up to 100 hp, 440 volts), there are factory-built unit controllers which can be assembled in true cubicle construction. A typical unit controller would contain the same standard control items as a combination starter. The frame and the door, however, are specially designed for assembly in the floor frame and all parts are accessible from both the front and back for maintenance. Fig. 8 shows a typical installation of this kind.

One advantage of this unit-cubicle construction is that each frame is self-supporting and as many frames can be combined as there is space available. The flexibility of the mounting possibilities of these factory-built units eliminates the objectionable features of special cubicle construction.

Richmond's Three-Year Record Shows Low Stoker Maintenance

H C Carroll, Commercial Testing and Engrg Co, reports on performance of water-cooled underfeed stoker installation, burning local coals, in Richmond, Ind., municipal power plant



Rear of water-cooled stoker, photographed during recent inspection (March)

Operating Data

Period	3/14/39 to 3/13/42, incl
Total steam generated, lb	1,412,899,100
Total coal burned, lb	166,929,100
Avg actual evaporation, lb/lb coal	8.46
Operating conditions	435 psi g, 700 F (temp of feed to economizer, 280 F)
Combined efficiency, %	82.8
Total cost, stoker-repair mat'l	$965.93
Avg cost, per ton coal burned	$0.0115

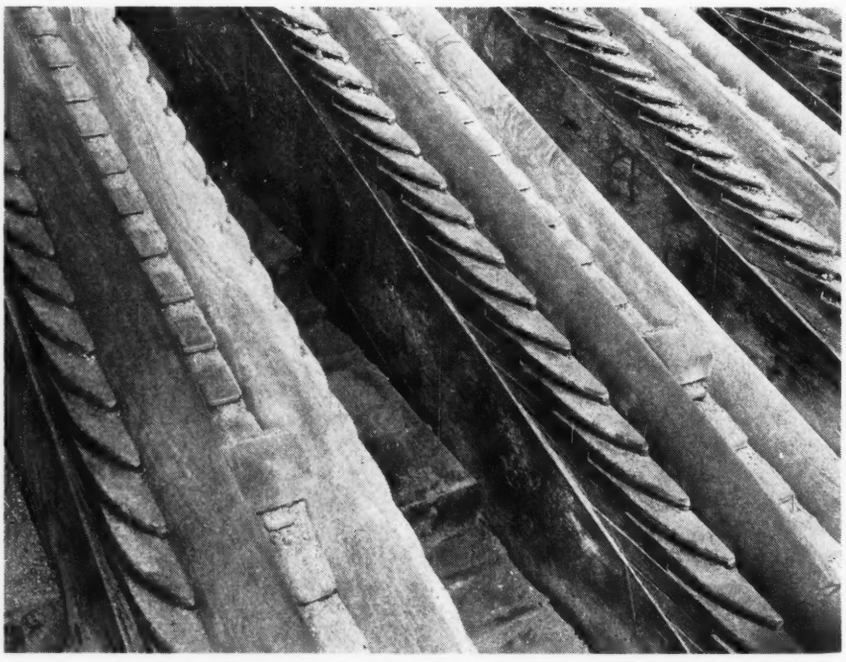
Coal Characteristics

Source	Indiana
Moisture, %	8.5 to 11.5
Ash, %	9.0 to 11.7
Sulphur, %	2.9 to 3.98
Ash-fusion temperature, F	2076 to 2230
Avg htg value, as fired, Btu/lb	11,340

▶ In March, 1939, the Richmond, Ind., municipal plant put into operation a Babcock & Wilcox Stirling boiler fired by an American Engineering Co water-cooled stoker. As described in Power (Jan. 1940) choice of stoker type and of an economizer instead of an air heater was predicated on the desirability of burning Indiana coals with minimum expense for maintenance.

This spring the new unit completed its third year of operation, giving a reasonable period on which to base conclusions as to how well the original design conditions have been met. The table at the right gives the figures.

Inspection in March, 1942, revealed no signs of wear on any rear or retort cooling tubes. Tuyere supports and tuyeres were in good condition and no parts of this nature have been replaced since the unit went into service. A careful check of the stoker side plates revealed the alignment in any section of the grate was within ¼ in. of the original design spacing.



Closeup view of retorts, tuyeres and cooling tubes taken during inspection. No original parts have been replaced on the underfeed section of the grate

THE OPERATING ENGINEER

George Edwards
Advisory Editor

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS—ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Additional Receivers Increase Compressed-Air Capacity

Much-needed air-storage capacity can be made from pipe, idle boilers and other spare parts around the plant. Charles A Armstrong explains how to figure the stresses

ALL-OUT PRODUCTION places extra burdens on plant facilities, sometimes causing serious overloads. Compressed-air requirements increase tremendously for construction and process work. Purchase of new equipment is limited, either because of piority or delivery problems. The plant engineer must combine his ingenuity with the material available in the salvage and scrap piles to keep his plant in condition to meet production demands.

Additional compressed-air storage provides capacity for peak loads and, when placed at the end of long distribution lines, smoothes out pressure variations. It acts as a reservoir to sustain pressure during heavy loads, reduces velocity flow through the supply line, and cuts friction loss. High-velocity flow through small lines results in an appreciable pressure drop at the receiving end. This slows up production by causing poor performance of air-operated equipment.

One solution to this problem may be found by constructing storage tanks from pipe that will withstand operating pressure. Spare parts such as blank flanges, or reducers of adequate strength, attached to the pipe make a serviceable receiver. An idle boiler approved for the air pressure used and connected only to the air system can be used for a large air receiver.

Before building a receiver, check state and local regulations to guard against code infractions; many states require that pressure vessels be constructed by approved methods. If in doubt, call in your boiler-insurance in-

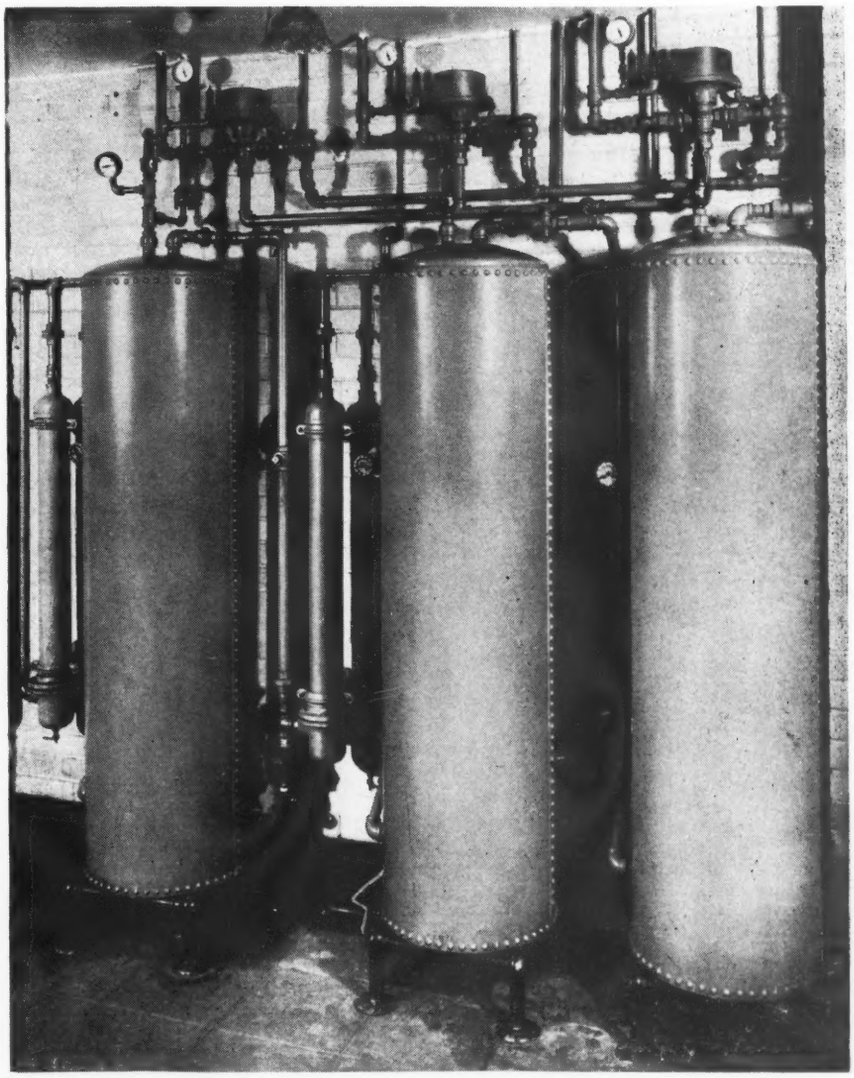


Fig. 1—Additional storage capacity installed at the ends of the distribution system smooths out pressure variations and reduces velocity flow through supply lines

spector. Where only pipe sections are available, heads capable of withstanding maximum pressure must be installed. Wall thickness of several pipe sizes and the pressures that they will safely carry are given in Table 1. For example, a 12-in. Schedule 30 pipe has a wall thickness of 0.330 in. and is safe for 250 psi, while Schedule 40 pipe of the same diameter has a wall thickness of 0.406 in. and is safe for 400 psi working pressure. These pipes may be good for higher pressures than given in the table, which can be calculated. To simplify the problem, however, stay within the limits given.

If the ends are to be closed by threaded flanges or reducers, extra-heavy pipe must be used so that threads will not reduce wall thickness below a safe minimum. Protect the receiver with an ASME standard safety valve of sufficient capacity to relieve the maximum compressor output and set it to blow at about 5 or 10% above normal working pressure.

Use Flange Steel

The following computations from the ASME Code illustrate the design of a receiver for 150-psi service constructed from 16-in. pipe with heads welded in place. Schedule 30 pipe is good for this pressure. To be sure your pipe is Schedule 30 or equal, check wall thickness against Table I. Actual storage capacity required will determine what length and diameter of pipe is necessary. Concave or convex heads require no internal braces but limited shop facilities may prevent their construction. Flat heads are simple and easy to install but generally require bracing. For heads it is preferable to use flange-quality steel. If this is not available, a steel of known weldability and of low carbon content, as evidenced by good ductility, should be used. Test the ductility by bending a 0.5-in. square strip of the metal 180 deg around a 0.5-in. pin, as shown in Fig. 3. Suitable steel will be free of cracks at the stressed area.

Head Thickness

Required thickness of the head in inches is determined by the formula:

$$t = d\sqrt{\frac{C\,P}{S}}$$

Where d equals inside diameter of the pipe in inches; C, a constant, use 0.5); P, maximum pressure in pounds per square inch; and S, maximum allowable working stress (use 11,000). Then for 150 psi on a head 16 in. in diameter

$$t = 16\sqrt{\frac{0.5 \times 150}{11{,}000}} = 1.32 \text{ in.}$$

It is apparent that when a flat unstayed head is welded in place, the thickness is considerable, even for a pressure of 150 psi. A thinner head can be used, if it is adequately braced or stayed. For small-diameter shells, one stayrod in the center of the heads usually will be sufficient. For a 16-in. shell, a number of symmetrically located stays is more practical than one of large diameter. Make the stays from round low-carbon steel stock, threaded at each end for an inside nut and long enough to extend through the head and fill a full outside nut. Recess the inner face of the brace nut, as in Fig. 4, for packing with a pressure-tight grommet of candle wicking and red lead. A flat iron washer having a hole somewhat larger than the brace permits better loading distribution; its large hole allows the grommet to seal the space against the head, preventing leaking.

Table I—Wall Thickness of Steel Pipe and Working Pressures

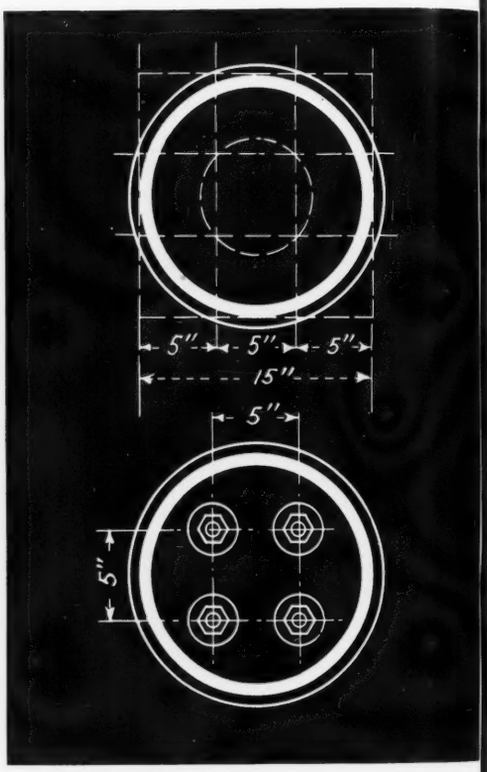
Inside diameter, in.....	8	10	12	14	16	18	20
Wall thickness, in. Schedule 30 — 250 psi (Old "Standard Weight")..	0.277	0.307	0.330	0.375	0.375	0.437	0.500
Wall thickness, in. Schedule 40 — 400 psi.....	0.322	0.365	0.406	0.437	0.500	0.562	0.593

Table II—Cross-Sectional Areas at Root of Threads on U S Standard Bolts

Outside diameter of bolts, in.....	¾	⅞	1	1⅛	1¼	1⅜	1½
Thread root area, sq in.....	0.302	0.420	0.55	0.694	0.893	1.057	1.295

How should the proper number and size of stays be determined? With symmetrical spacing in shell diameters under 20 in. and for head-plate thickness of at least ½ in., there is little likelihood of exceeding the maximum allowable pitch for the stays. The number of stays, then, should be determined. A stay less than ¾ in. in diameter is not good practice. A very large brace may not be practical. Then, let us assume that symmetrical spacing would require four braces to remain within the allowable pitch of 7⅛-in. for a ½ in. head at 150 psi (ASME Code).

Fig. 2—Thin heads are permissible if they are supported by substantial stay rods fitted with inside and outside nuts or other approved methods of fastening such as screwed or formed head stays



To find the required size of the four stays, use the formula

$$A = \frac{P \times H^2}{S}$$

where A equals least cross-sectional area of the stay in sq in.; P, maximum allowable pressure; H, maximum pitch of stays in inches; and S, maximum allowable stress in stays, psi, (use 7500). Pitch layout is shown in Fig. 2A.

Then, for 150-psi pressure in a 16-in. tank with a ½-in. head and maximum stay pitch of 5 in. we find the area of each stay

$$A = \frac{150 \times 5^2}{7500} = .50 \text{ sq. in.}$$

Table II gives cross-sectional areas at the root of the treads of U. S. Stand-

ard bolts. A 1-in. rod is the nearest standard size that will meet requirements, thus four 1-in. stayrods should be used.

For higher pressures or larger shell diameters, more stays may be desirable instead of increasing the diameter of the stayrods. Fig. 2B shows a tank laid out for four stays equally spaced.

To check the strength of the head, use a formula from the ASME Code for Unfired Pressure Vessel (for stayed surfaces)

$$P = C \times \frac{T^2}{P^2} \times \frac{S}{11000}$$

where P is the safe working pressure; C is a constant, for this purpose use 135; T is thickness of head in sixteenths of an inch; p maximum pitch of stay bolts; and S allowable working stress of head material, use 11000 psi.

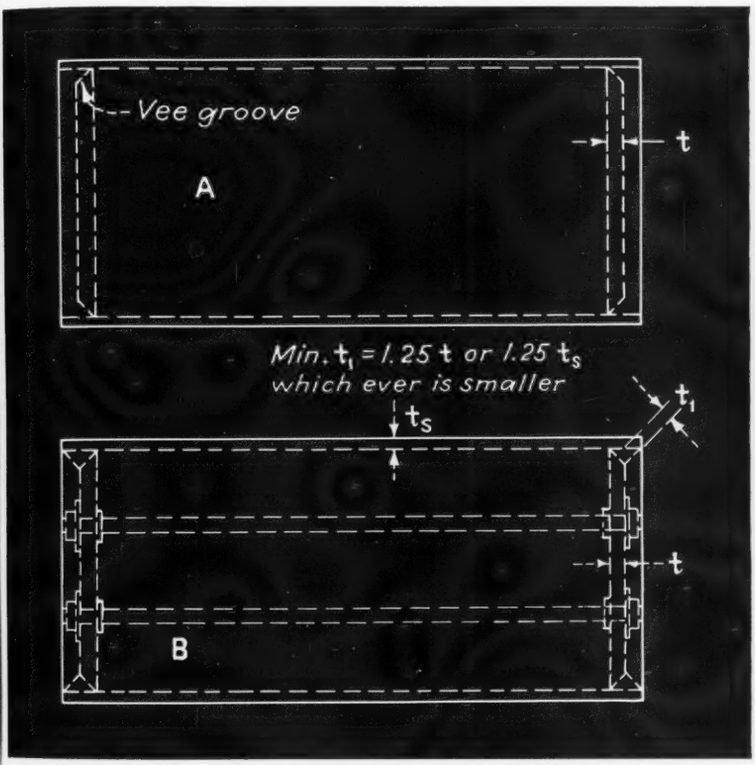
$$P = 135 \times \frac{8^2}{5^2} \times \frac{11000}{11000} = 346 \text{ psi}$$

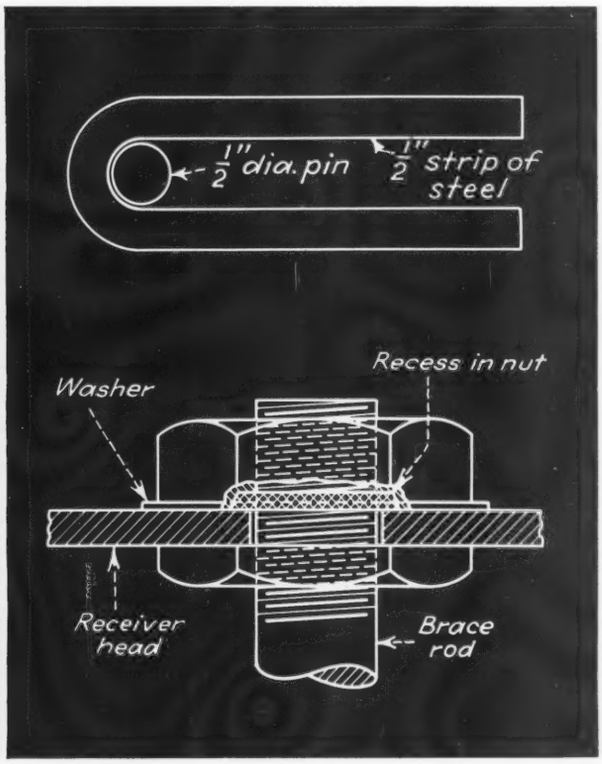
Thus the head metal is amply strong for 150 psi.

Threaded pipe connections usually will not be over 2 in. diameter. A wall thickness of $\frac{7}{16}$ in. is required to provide the proper number of full threads. The heads will almost always be ½ in. or greater, providing sufficient thickness for screwed pipe connections. The heads should also have small inspection openings kept closed with pipe plugs. After one head is welded in place lock the staybolts in position. Adjust the inside nuts for even bearing against the second head and then tighten the outside nuts before welding the second head in place.

Fig. 3—Metal of necessary ductility will not show signs of cracks or fractures

Fig. 4—Leakage at nuts is prevented by filling recess with grommet packing





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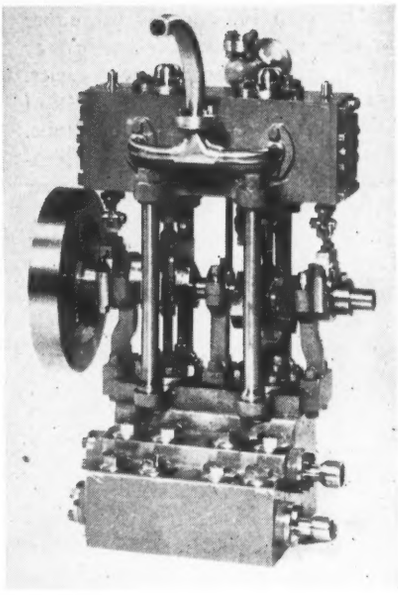
Teacup-Size Feed Pump

▶ Fred D Hood, Power's model-maker friend in Los Angeles, is known to many readers from the previously published descriptions of a model Scotch marine boiler and triple-expansion marine engine on which he has been working for years. Editor Swain inspected these models at Mr Hood's home in Los Angeles in 1939, and pronounced them the finest he had ever seen in perfection of detail and workmanship.

Recently completed by Mr Hood is this feed pump for the miniature plant. Height is 4½ inches overall. Like all of Hood's models this is a real working machine, complete and precise in every detail.

Hood's letter read: "It (the pump) is thoroughly old fashioned, but so is the rest of it (the plant)—a relic of a dying race. At sea we used to call that type of pump Old Reliable. Those with steam-operated valves would stick sometimes, but Old Reliable never. Only one more auxiliary to make now, the circulating pump engine, then the fun is over. Well, it was worth all the pains. Although I am 74 now I don't seem to slow up any; I have a 9-in. engine lathe under way now for my grandson."

(Mr Hood would probably enjoy the triple-expansion engines in the new Liberty ships. See page 64.—Editor)



How to Buy a SECONDHAND BOILER

With the cream of the secondhand boiler crop gone, careful selection is more necessary than ever. Harry Spring gives practical tips on methods of inspection and test

THE SECONDHAND BOILER field has seen tremendous changes since the article "Buying a Secondhand Boiler?" appeared in POWER almost three years ago (Sept, 1939). Then depression conditions had caused an increase in the number of secondhand boilers on the market. Now, with most plants seeking ways of adding capacity and with boiler manufacturers struggling to meet enormously expanded demands, many engineers have turned to the secondhand market as a solution. The cream of the crop has now been taken, with a few exceptions.

While there are still a few available, some are definitely unsafe for anything but scrapping. A limited number may yet be found to fill the needs of industrial plants unable to secure new boilers. However, far greater caution must be used in selecting a secondhand boiler than ever before.

The previous article stressed the selection of a boiler to meet operating conditions. This angle is just as important now and this article will cover it briefly. But it is even more important today to know that the boiler bought is safe and dependable for tough service, even if this means choosing a unit that is not most suitable for the operating conditions.

Watertube units

For operating pressures above 150 psi, a watertube boiler usually represents the best choice, except for small units. Between 100 and 150 psi, either a firetube or a watertube boiler may be used; selection depends on capacity. Units with more than 2500 sq ft of heating surface are usually watertube. For sizes below 2500 sq ft and pressures below 100 psi, a firetube boiler usually gets the call.

Floor space and headroom affect selection. If floor space is limited and a unit of moderate size is desired, look for a vertical boiler. Need for large capacity usually dictates a watertube vertical; firetube units fill the bill in smaller sizes. Limitations on headroom call for either a horizontal firetube boiler or a low-head watertube unit, depending on capacity required.

If the boiler must meet widely fluctuating steam demands, be sure that water-storage capacity is ample. Also consider the adaptability of the boiler design to the method of firing to be used. In many cases, changes in the setting and furnace will be needed to get best results on a given fuel.

So much for the need to meet operating conditions. For consideration next are the requirements of local boiler laws. Despite the outstanding progress toward safety in boiler construction under the ASME Code for Power Boilers and the administration of boiler laws by the National Board of Boiler and Pressure Vessel Inspectors, a number of states still have no boiler laws and among those who have adopted the Code there are some whose individual boiler ordinances are peculiar and non-reciprocal. For a summary of boiler laws in the U. S. and Canada, see *Synopsis of Boiler Laws, Rules, and Regulations,* published by National Bureau of Casualty and Surety Underwriters, 60 John Street, New York, N. Y.

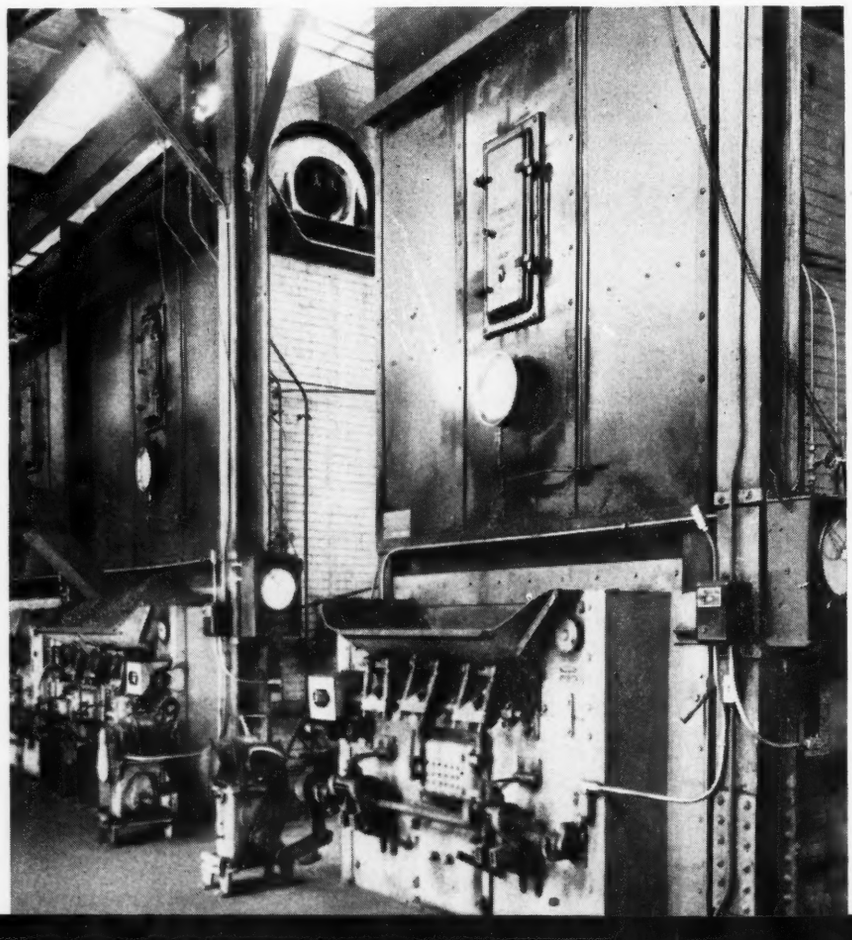
Presence of a "stamp" on the boiler is important. It not only shows the age of the boiler, the maximum pressure for which it was constructed and the name of the maker, but it may also show that the boiler was built "ASME Standard", a guarantee of construction and workmanship.

Non-standard boilers are not allowed for reinstallation in many states except under certain conditions. Because of lack of unification in boiler laws these conditions vary. As a rule, a non-standard boiler cannot be installed in a state unless it has been in that state prior to the adoption of its boiler code. Many states having boiler laws require application for permission to install a secondhand boiler. This should be looked into before buying a boiler and the engineer should be sure that the boiler will meet local requirements.

Several states limit the maximum pressure to 50 psi on a boiler over 30 years old and having a longitudinal lap-riveted joint. Some states prohibit reinstallation of any boiler having a longitudinal lap-riveted joint over 12 ft continuous length. Watertube boilers with cast-iron headers usually are limited to 160 psi.

Safety factors determine the maximum allowable pressure. In some states the factor of safety must be increased every

Watertube boilers meet a variety of needs in higher pressure and capacity ranges



five years after the boiler reaches a certain age. The factors are seldom less than 5 and may increase to 8 or more. The step-up in safety factor requirements means a sliding scale for maximum allowable pressure. The purchaser of a boiler should be sure that local requirements will not reduce the allowable pressure below the necessary operating level a year or so after the boiler is installed.

Inspection of a secondhand boiler by an authorized inspector is a requirement in most "Code states". An "authorized inspector" usually means a boiler inspector commissioned by the state, whether he be employed as a state inspector or by a boiler insurance company authorized to do business in that state. Inspection is always desirable, to reveal dangerous defects.

Space does not permit a complete discussion of causes, nature and repair of boiler defects. The following is a general outline of the more common defects found in a boiler, together with some brief descriptions.

Cracks that do not affect the strength of the boiler, such as a limited number of small fire cracks, may not be of much consequence. Repairs by veeing out, removing adjacent rivets, welding and redriving the rivets are usually proper. Cracks in stayed areas may often be repaired by welding.

Lap-seam cracks, longitudinal cracks in shells or drums and most cracks in unstayed areas preclude reuse.

External corrosion, if localized or extensive in unstayed areas, may be evidence of a hazardous condition. If it has not reduced the plate thickness by more than 40% and if it is not a stayed area, the plate may usually be built up by welding. Corrosion at the edges of handhole openings may usually be repaired by reinforcing the plate with an inside elliptical ring.

Bottoms of box headers in water-tube boilers are often exposed to corrosive action. Investigation of all concealed points should be made. Repairs may require either building up by welding or replacement of defective metal by a patch.

Internal corrosion of a shell or drum may seriously weaken the structure. Pitting is a form of internal corrosion, but if it is widely scattered and not deep, the weakening effect will be negligible. Extensive internal corrosion may deteriorate the plate to such a degree that repairs would not be practicable. Operation at appreciably reduced pressure may be required for safety.

Overheating of a boiler may manifest itself in any one of several ways. Discoloration of plates and burning off of soot are usually the first indications. Leakage from those parts first uncovered by an excessively low water level will also result. However, a secondhand boiler may have been removed from operation for such a long period of time that careful scrutiny would be necessary to disclose any of these.

Distortion of boiler tubes may be caused by internal and/or external corrosion, erosion, or any combination of these factors. The weakened condition may be localized in certain tubes while others may be in good condition. If a tube is suspected of being abnormally reduced in thickness, it is always best to remove it and cut a section from the tube so that the thickness may be calipered. In this way, condition of other tubes may be judged by comparing their performance under hammer test with the tube which has been calipered.

All possible defects that may be found in a steam boiler have not been listed here. Neither has it been possible to go into details of inspection and repair. However, this outline of common defects should be sufficient to emphasize the need for careful inspection of any secondhand boiler.

As emphasis has been placed on the need for inspecting secondhand boilers, it does not seem out of place to conclude with a few of the important details that make thorough inspection possible.

Adverse Conditions

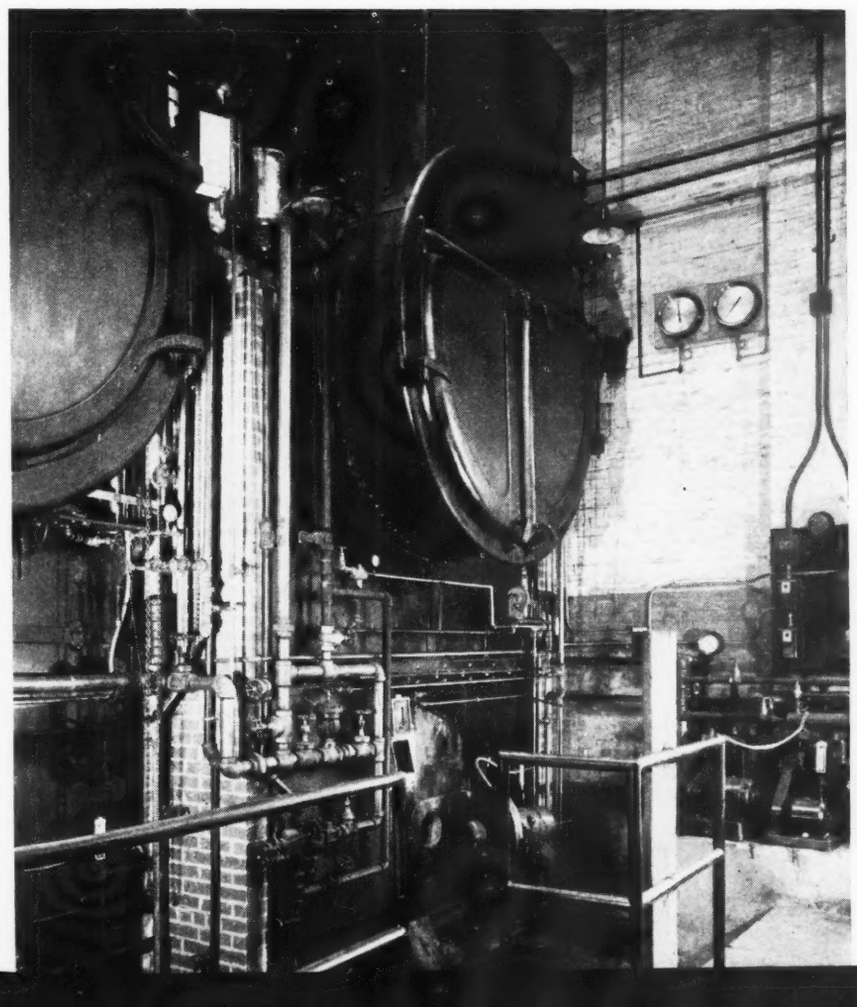
The inspector must often work under adverse conditions when inspecting secondhand boilers. Adequate help may not be available; the boiler may have been abandoned for a long period of time and may be exposed to the elements even at the time of inspection, and numerous other difficulties may be encountered.

A prime requisite is that all internal and external surfaces of the boiler be clean and dry. Often brickwork concealing riveted seams should be removed. Water should be available in case the inspector requests a hydrostatic test. If water under pressure is available, the inspector should be advised of the maximum water pressure available before the date of the inspection. With this knowledge, he may be able to decide if it will be necessary for him to supply a test pump.

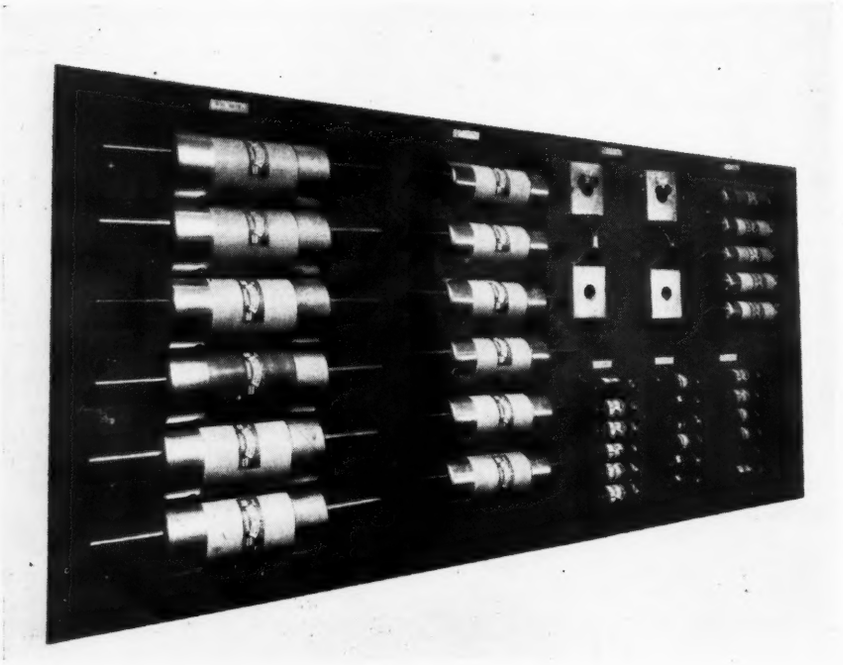
Responsible workmen should be available to assist the inspector. Also, safe ladders should be at hand. An electric drill should be at his disposal in case it is found necessary to drill test holes.

Considerable time may be saved if records of the history of the boilers are secured for review at the time of inspection. The records should include the name of the manufacturer and the year built, unless this information is stamped on the boiler. Included also should be names and addresses of all previous owners or users of the boiler.

Firetube units find wide use in sizes below 2500 sq ft, at pressures under 150 psi



PRACTICAL AIDS TO OPERATION



Fuses Made Available For Immediate Use

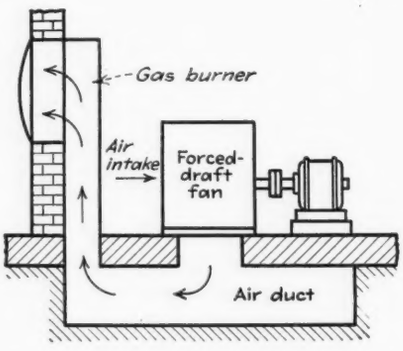
WHEN YOU WANT A FUSE you generally need it in a hurry to get a machine back in service. All the circuits on our switchboard are protected by fuses ranging from 800-amp links and 400-amp inclosed designs to 25-amp cartridges. To be sure that these fuses will always be available in case they are needed I built the fuse board shown in the photo.

Knife terminal fuses are supported by two pieces of fiber, slotted at an angle of about 30 deg below the horizontal so that the fuses fall back in the slots. Cartridge fuses are held in light metal channels and the links hang on pegs. This board is placed near the switchboard where the fuses are easy to get when needed. The board is also where it is always in view and one of the unpardonable sins of the plant is for one of the watch engineers to use a fuse from the board and not replace it immediately.

Long Island City, N. Y. J F MACGOWAN

Water in Air Duct Reduces Boiler Draft

ONE NIGHT WE HAD TROUBLE getting sufficient draft for one of our gas-fired boilers, which has a forced-draft fan. After adjusting the damper and trying other means to get the necessary draft, we looked in the furnace and saw water blowing into the fire. As shown in the diagram, combustion air discharges from a forced-draft fan into a duct below the floor and then up to the gas burner. Drilling a hole through the floor above the forced-air duct showed it to be partly filled with water, which restricted the air flow.

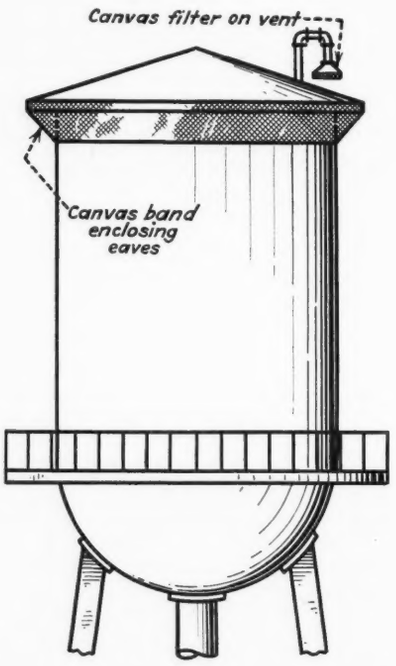


We rigged up a pump and pumped the water out after which draft conditions became normal. The water, we found, came from some distance away and leaked into the duct through cracks in the concrete. Inspection holes with covers are now provided in the floor above the duct so that we can keep watch for water and remove it before it gets high enough to interfere with the furnace draft.

Lordsburgh, N. M. JAMES BURRUSS

Canvas Filters Protect Elevated Water Tanks

WATER IN ELEVATED TANKS near power stations frequently becomes contaminated with cinders or flyash. This is especially bad in process industries where gritty particles may seriously endanger product quality. Even though water tanks used in industry are usually covered, covers are not air tight and vents must be provided. Wind-borne stack dust entering the tanks through these openings must be controlled if the water or other liquid is to be kept free from grit.



One large chemical plant has overcome this difficulty by covering all openings with heavy canvas. As shown in the drawing, vents are provided with filters having a much greater area than that of the pipe so that there will be little if any interference with the flow of air when filling and emptying the tank. Canvas used is treated to prevent deterioration but is not waterproofed to avoid interference with proper movement of ventilating air vent.

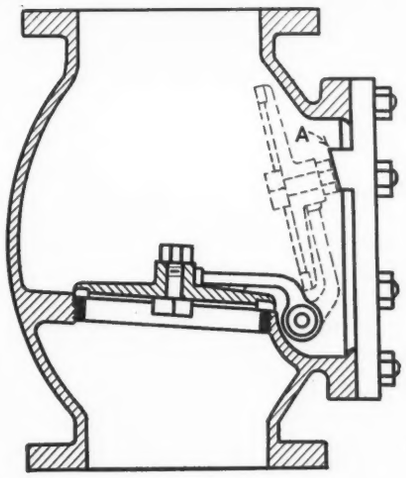
Lynchburg, Va. O M ROBERTS

Extended Stop Prevents Check-Valve Slamming

SLAMMING OF CHECK VALVES by reversed liquid flow may cause water hammer sufficient to open pipe joints. To eliminate this trouble check valves must be adjusted to close before flow reversal gains serious momentum. In one installation, water hammer in a station sump-pump discharge line was great enough to surge the piping back and forth on its hangers.

The pump was installed in the sump and discharged through an 8-in. line against a 50-ft head. A vertical check valve was installed 10 ft above the pump.

Water hammer in the pipe, while not eliminated entirely, was reduced to a

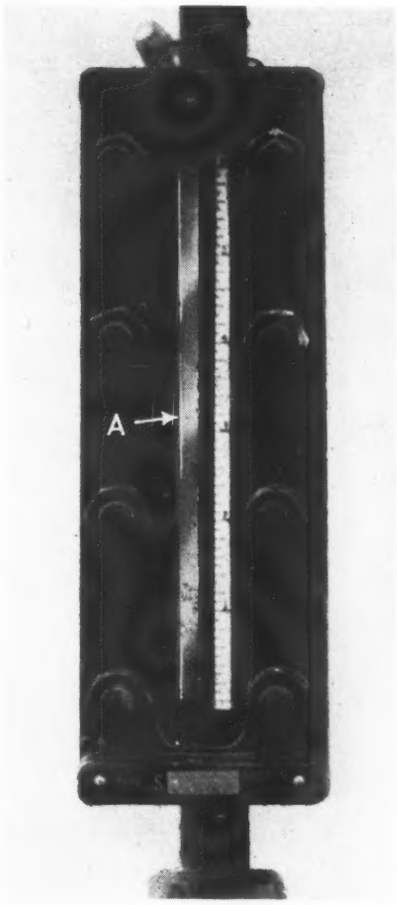


reasonable amount by extending the check-valve flap stop as shown at *A* in the figure. This extension decreased the angle of the flap opening making it fall closed before reversed flow had gained much velocity. The new position of the flap did not cause any serious flow restriction.

Detroit, Mich. L R CARRY

Mirror Aids Gage-Glass-Reading Accuracy

WHERE CALIBRATIONS on a tank in which close measurements are desired

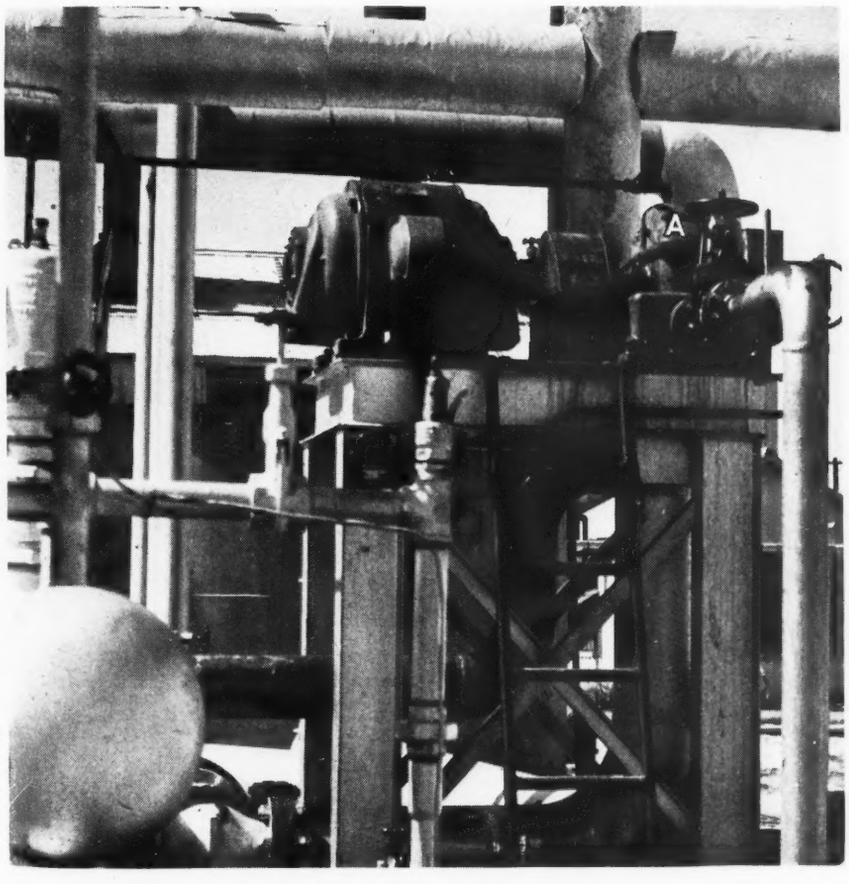


are related to graduations on the scale of the sight glass, parallax in observation may throw off the readings sufficiently to introduce a serious error. To insure accurate readings, one test engineer cemented a narrow strip of mirror to one side of his gage glasses opposite the calibrated scale, as at *A* in the photo. Now, when reading the scale it is necessary only that the observer see the pupil of his eye in the mirror at liquid level as he reads the scale, to eliminate any error due to parallax. On tests, where rate of flow of liquid is being measured by timing the filling of a calibrated vessel between predetermined marks, possibility of error is reduced by the observer keeping his eye level with the upper

Turbine Replaces Pressure-Reducing Valve

A PLANT CIRCULATING large quantities of fluids at a constant rate at 500 psi, reduces the fluid pressure to discharge over atmospheric regenerating towers. Pressure reduction to atmospheric is being utilized as a source of power in an experimental pilot plant. Instead of reducing the pressure through an automatic reducing valve as done on several other vent lines, a small water turbine *A* has been installed, as in the photo. This turbine connects directly to an electric generator, both mounted on an adequate supporting platform to produce power otherwise wasted when the pressure was reduced.

Santa Monica, Calif. JOHN C ALBRIGHT



mark on the scale and stopping the watch as the liquid column reaches the height of his eye.

Use rubber cement to attach the mirror to the scale as this gives a flexible attachment which will accommodate any slight variation in expansion and contraction between mirror and gage glass, and also tends to protect the coating on the mirror.

Houston, Texas CHARLES C LYNDE

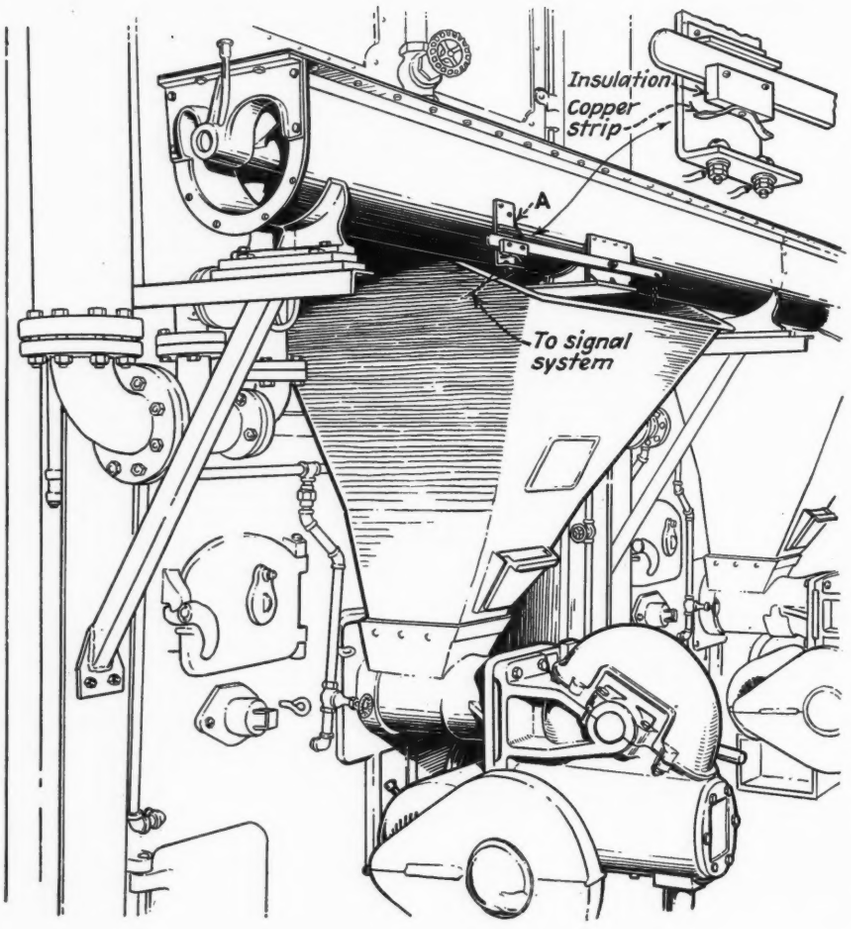
Welding Returns Engine to Service Quickly

WHEN A NOISE in a poppet-valve, 28x32-in. engine crank connection caused the engineer to shut it down, he found one of the wedges with a threaded stub broken off about 3/8 in. from its shoulder, as at *A* in the photo. A call to the engine builders brought the discouraging news that a new wedge could not be delivered in less than

three days. The engineer then decided to repair the old one by welding.

After heating the old stud wedge to about 700 F he welded a section of chrome-manganese-steel rod to it, using an electrode designed for joining high-carbon or alloy steels to be machined and heat treated. After cooling, the stub was turned to size and threaded and in six hours after shutting down the engine it was back in service. The repair was made at a shop cost of $3.25, while a new wedge would have cost over $60 and the engine would have been down for at least three days.

Milwaukee, Wis. ANTHONY SINKLAIR
Harnischfeger Corp



Low-level Alarm for Stoker Hoppers

COAL IS FED TO THE HOPPERS of our stokers by a screw conveyor, as in the figure. As the hopper top is quite high it is not easy to tell when the coal gets low.

We solved this problem by pivoting an arm on the side of the conveyor above each hopper, as at *A*. On one end of the arm we attached a piece of light chain that hangs down the side of the hopper to the level above which we want to maintain the coal. On the other end of the arm we attached an insulated strip-copper contact and directly below it mounted the signal-system insulated contact on a bracket supported from the conveyor side.

The contact end of the arm was made heavier so that when the chain was free from the coal in the stoker hopper the contacts would close and light a lamp and ring a bell. As long as coal in the hopper is above the minimum level it pulls down on the chain against the side of the hopper and holds the contacts open. We had to do some experimenting to get the right length of chain, but after this problem was solved the alarm system worked satisfactorily.

New York, N. Y. S M ELONKA

Loose Armature Core Breaks Coil Leads

HIDDEN FAULTS SOMETIMES cause a lot of trouble before they are discovered. On an armature in one of our dc motors the coil leads would break for no apparent reason. After this had occurred and had been repaired several times the armature winding was in such bad condition that it had to be rewound.

After we removed the old coils from the core, someone got the idea that the armature core might be loose on its shaft. We put a lathe dog on the armature shaft, centered it in a lathe and anchored the core to the tool post. Then with a bar between the lathe dog and armature shaft we tried turning

the shaft first in one direction and then in the other.

A movement of about $\frac{1}{32}$ in. was obtained, because of an undersize key. When the core was properly keyed to the shaft and the armature rewound we had no further trouble with broken armature-coil leads.

Philadelphia, Pa. R O SPENCER

Test Equipment for Low-Pressure Gages

THE AVERAGE DEAD-WEIGHT gage tester cannot be used for testing vacuum gages and is of little use for testing low-range pressure gages. Two simple testing devices that serve these purposes can be made from odds and ends usually found around the plant laboratory, or purchased at little expense.

One of these, Fig. 1, for testing low-pressure gages is made from a glass U-tube, rubber aspirator bulb, glass tee, pinch clamp, some rubber tubing and a small amount of mercury. These are assembled as shown and the U-tube filled about half full of mercury. Be careful to remove all air bubbles, and leave free end of U-tube open to atmosphere.

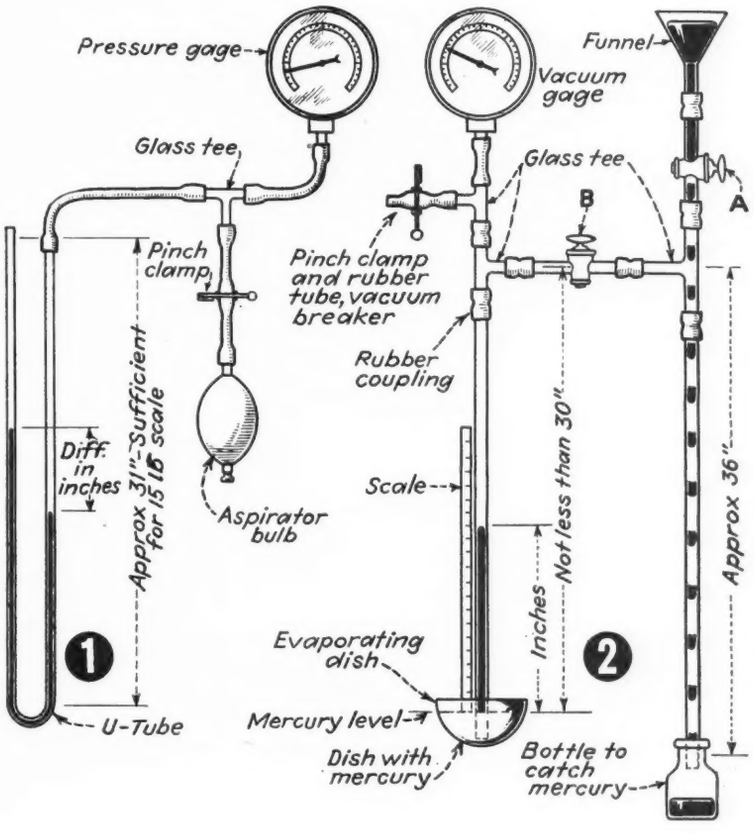
To operate, pump air into the system with the aspirator bulb to obtain the desired pressure on the gage. Measure the differential pressure in inches shown by the U-tube and divide this by 2.036 to get the pressure the gage should read. By increasing the pressure in increments the gage may be checked at several points. Pressure of 12 to 15 psi may be obtained with the ordinary aspirator bulb.

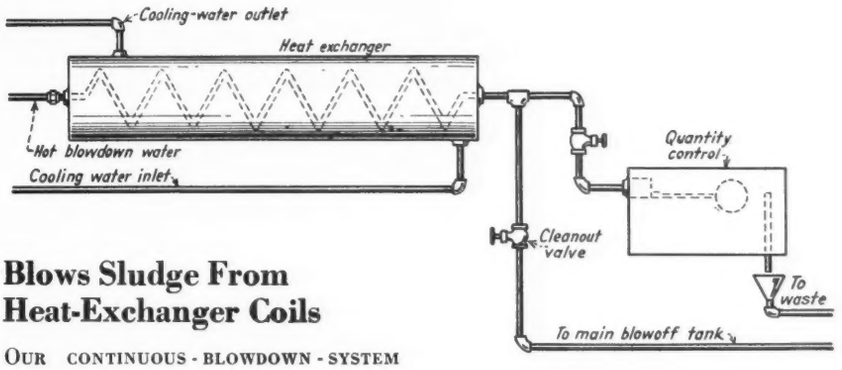
For testing vacuum gages the equipment is a little more complicated. Parts necessary are a glass funnel, glass and rubber tubing, three glass tees, two glass plug cocks, an evaporating dish, a scale, a pinch clamp and 10 to 15 lb of mercury. Mount the equipment and the gage to be tested as in Fig. 2. Place the evaporating dish so that the tube is near its bottom and fill the dish with mercury as shown. Close cock *A*, open *B*, empty a bottle of mercury into the funnel and place the empty bottle below the lower end of tube to catch the mercury after it comes down the funnel.

When everything is ready slowly open cock *A* to the point where slugs of mercury flow down the tube to the bottle. These slugs act as a pump piston to remove the air from the tubing, and create a vacuum. A little experimenting will determine the proper amount to open cock *A*. Too small a flow of mercury will allow it to be sucked across the tee into the left-hand glass tube and too fast a flow will not permit the mercury to break up into slugs, causing a slow pumping action. When the desired vacuum shows on the gage close cocks *A* and *B* and measure the height of the mercury in the tube above the level in the evaporating dish. This should be the same as the gage reading if the latter is correct.

When all joints are tight a vacuum can be produced easily within 0.5 in. of the barometer. Use heavy rubber tubing so that it will not collapse under high vacuum. Both testers illustrated can be mounted on a board and used either in the laboratory, or taken into the plant. The latter is especially convenient for testing recording vacuum gages, particularly where the instrument is a multiple-pen unit.

Tecumseh, Kansas H M NAYLOR





Blows Sludge From Heat-Exchanger Coils

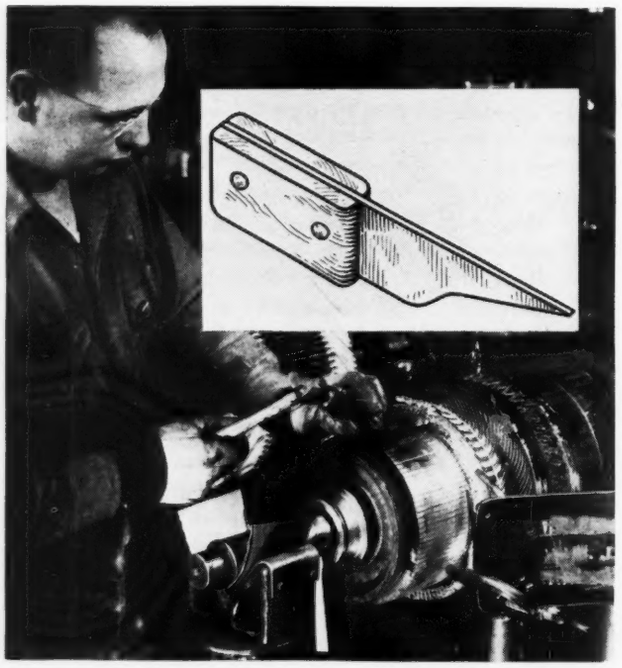
OUR CONTINUOUS-BLOWDOWN-SYSTEM heat-exchanger coil surface frequently became fouled with mud-like deposits, composed of suspended matter in the blowndown water, that seriously reduced the heat-transfer efficiency. To eliminate this we installed a clean-out valve between the heat exchanger and the blowdown quantity control, as in the diagram. The comparatively slow flow through the heat-exchanger coils is the chief cause of sludge deposits. To clean out these deposits we now open the cleanout valve for about one minute on each shift. This has proven sufficient to keep the heat exchanger clean and operating at high efficiency.

Roanoke, Va. S H COLEMAN

HOW TO CHANGE COMMUTATOR LEADS

Pictures posed by POWER's photographer in the Newark, N. J., manufacturing and repair department of the Westinghouse Electric & Manufacturing Co

▶When armature or commutator repairs require the unsoldering of coil leads, proper preparation and the correct tools will speed up the job. Before removing the commutator always inscribe reference lines on armature face in line with a commutator bar to assist in replacing commutator in correct relation to the brush position.



1. Direct torch flame at commutator risers, applying only sufficient heat to melt the solder. Drive the point of a thin foot-shaped tool under the lower lead. Using tool heel as a fulcrum raise the leads and bend them back away from the riser slot

2. Place coil leads in riser and cut flush with riser face. Insert thin wooden filler wedges between risers to prevent entrance of solder. Use resin flux. Adjust gas flame against a flat-pointed iron at a convenient position for soldering operation

3. Place armature in lathe and remove excess solder from face and top of risers. Remove wooden filler wedges from between

risers and remove solder at riser roots. Test armature for short-circuited coils or bars and reband the coil leads compactly

How to Figure Beams–No. 1 BY PHIL SWAIN

▶ THIS STARTS A NEW SERIES on beams. With as little mathematics as possible —nothing harder than simple arithmetic—the articles will explain how beams act under load and will show how to figure *beam strength* for conditions commonly encountered.

The reader of this series will not become a structural engineer competent to frame steel buildings and bridges. But on the other hand, he will learn how to tell whether a certain timber or I beam, used in a certain manner, can safely carry a given load.

The sketches and captions practically tell the story in this first lesson, so only a few general comments will be necessary. For a given load and span the cantilever (projecting) beam, Fig. 1, undergoes the greatest stress.

Note particularly that bending *curves* a beam and that this curvature is greatest where the stress in the material is the greatest. This is clear from Fig. 3 and 4, because curving always stretches the convex side and compresses the concave side. Somewhere between these (half way between for a symmetrical section) is a *neutral axis* whose length is not changed and which is neither compressed nor stretched. Note that the top and bottom of the beam do most of the work in resisting bending.

Bending moments in a beam are figured just as you would figure the twist of a wrench on a nut, multiplying the load by the lever arm with which it acts. The captions show how this applies to the cases shown in Fig. 5 and 6.

Computations like this show what section of the beam is most severely strained and how much. The bending moment at any section of the beam is "bucked" by an equal and opposite bending moment produced by stress in the metal of that section. Thus in sections like 7 or 8, for example, each little spot of metal under compression or tension helps resist the external bending moment with a lever arm equal to its distance from the neutral axis. All these little moments add up to create the total resistance of the section to bending.

The metal is most severely stressed at the top and bottom of the section. The total resisting moment created in any section of a loaded beam is the *strength of the section* multiplied by the unit stress existing in the metal at the top or bottom of that section. Thus the section strength S (section modulus) of Fig. 9 is 8. If a beam of this section is bent until its top and bottom fibers are stressed to 1000 psi, the bending moment in the section will be $8 \times 1000 = 8000$ lb in. The next article will show how to determine S in practical work and how to use it in selecting and figuring beams. Where conditions are normal this is a simple operation.

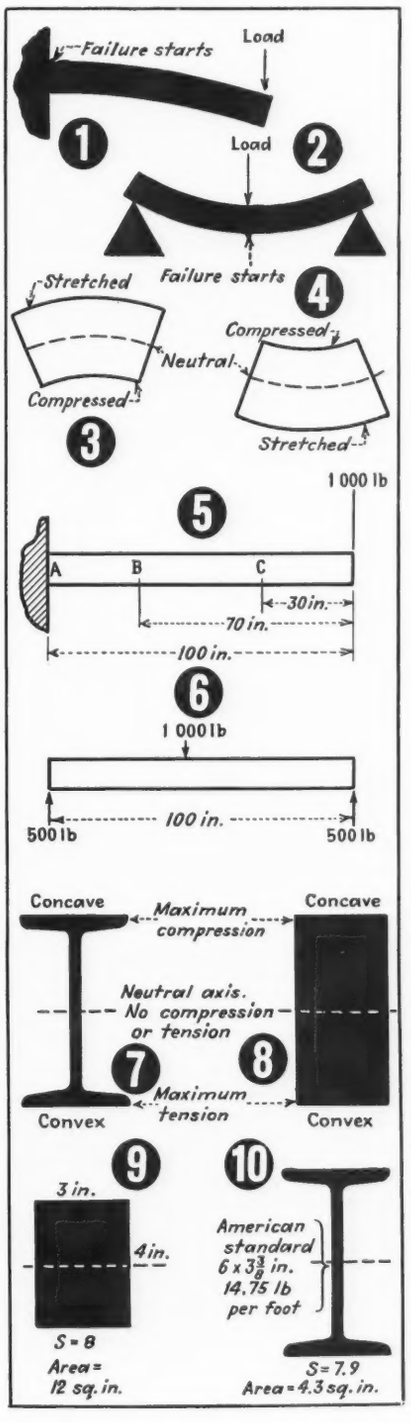


Fig. 1—Greatest tension in a *cantilever* beam is on the top side at the point of support

Fig. 2—In a *simple* beam with concentrated load, greatest tension is on bottom side directly under load

Fig. 3 and 4—Where any portion of a beam is curved by elastic bending the convex side is stretched (under tension) and the concave side is compressed. Between is a "neutral axis" which is neither stretched nor compressed

Fig. 5—In a cantilever beam with a single concentrated load the bending moment at any section equals the product of the load by its lever arm or distance to the given section. Thus, moment is 100,000 lb in. at *A*, 70,000 lb in. at *B* and 30,000 lb in. at *C*

Fig. 6—In this simple beam with a single concentrated load of 1000 lb at the center, upward thrust of each support is 500 lb. Maximum bending moment at *A* equals force x lever arm = 500x50 = 25,000 lb in. (Note that the 1000-lb load produces no bending moment at the load because its lever arm is zero)

Fig. 7 and 8—Concave side of the beam is compressed and the convex is in tension. Working toward the center of the section, tensions and compressions taper down to zero at the neutral axis. An efficient beam shape provides as much metal as possible at a good distance from the neutral axis. An I beam is a good example of efficient beam section

Fig. 9—The letter "S" (meaning "Section Modulus") denotes the "strength" of the cross-sectional shape in resisting bending, as distinct from the strength of the material of which the beam is made. For a rectangle, S = width x depth x depth ÷ 6 (all dimensions in inches). Thus S for section shown is 3 x 4 x 4 ÷ 6 = 8

Fig. 10—For standard structural shapes take S directly from the handbooks. Note that this I beam has practically same S as the rectangular section of Fig 9, but with only 36% of the area. Thus it gives the same strength with 64% less material. It does this because the beam design places most of the metal well out from the neutral axis where its tension or compression can work with the maximum lever arm (measured from the neutral axis)

READERS' PROBLEMS

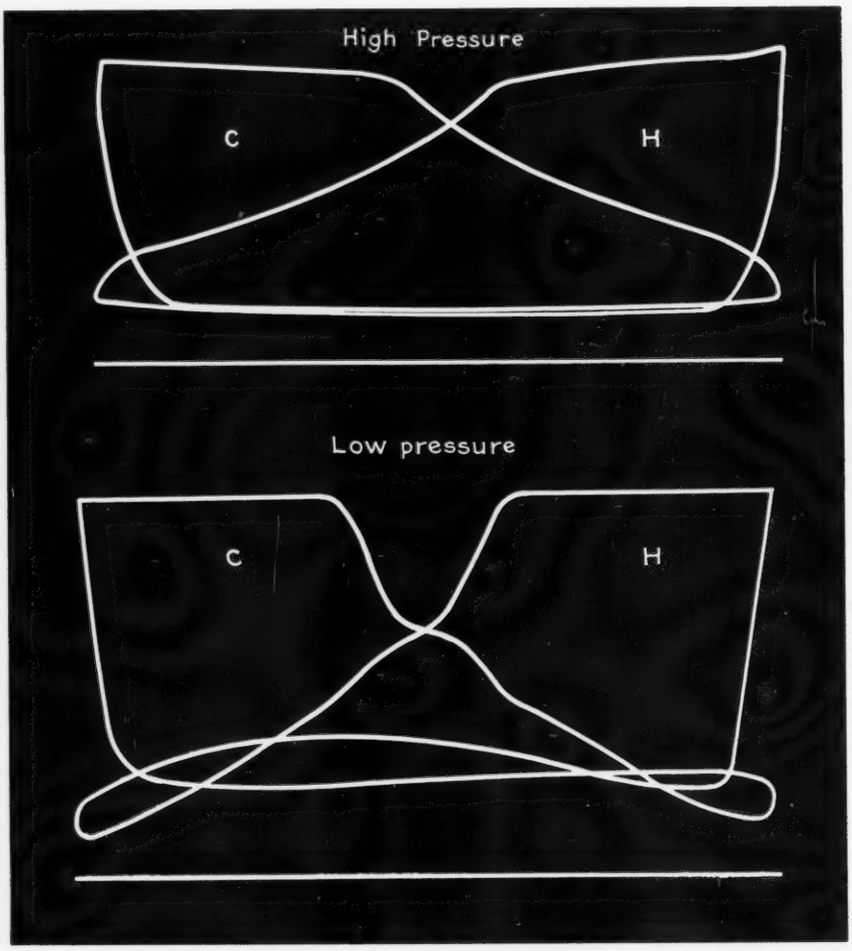
Questions from Our Readers

What's Wrong with This Engine

Question 1

THESE INDICATOR DIAGRAMS *were taken from a tandem-compound double-eccentric releasing engine. They were taken at 270-hp load, steam pressure 150 psi, receiver pressure 25 psi, and exhaust pressure 4 psi. An 80-lb spring was used on the high and a 10-lb spring on the low-pressure cylinder. The high-pressure cylinder is 15 in. in diameter and the low-pressure 30 in. with a 36-in. stroke operating at 104 rpm.*

What is the best procedure to follow in correcting the valve settings? What is causing the loops and hump in the exhaust line of the low pressure cylinder?—GIW



Question 2

How to Align Line Shafting

I WOULD LIKE TO HAVE *the opinions of* POWER *readers on the correct procedure for aligning line shafting. Should the alignment be done with the belts on or off the pulleys? It appears to me that if the shafting is aligned with the belts off the pulleys the increased loading when they are in place will cause misalignment. I believe this should be checked under or as closely to operating conditions as possible.*—CAA

Does Remelting Injure Babbitt Metal?

Answers to May Question 1

The Question

IT IS OUR PRACTICE *when rebabbitting bearings to melt out the old babbitt, add a small amount of new metal and reuse for the rebabbitting job. Some of the rebabbitted bearings have been giving trouble from overheating and wearing faster than they should. Probably some of* POWER'S *readers can tell us if repeated melting of this metal injures it and what is the cause of our bearing trouble. Oil grooves were cut in the same position in all bearings.*—ORW

Use Reclaimed Metal For Secondary Bearings

OUR EXPERIENCE over a period of years duplicated that of ORW in regard to bearings poured with virgin and reclaimed babbitt metal. Other conditions being the same, bearings poured with virgin metal have consistently given better service and longer life. On numerous occasions special precautions were taken in pouring bearings using reclaimed metal to assure the bearings being clean, properly tinned and preheated; a pyrometer was used to assure that the metal was poured at proper temperature. In the great majority of cases the result was the same; the virgin-metal bearings gave better service than reclaimed metal bearings.

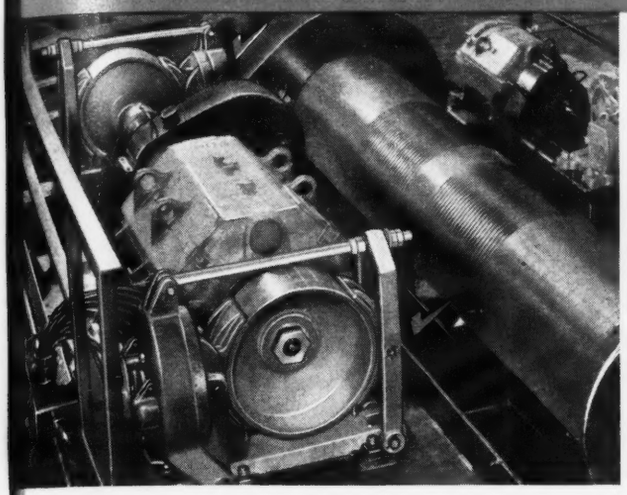
We can offer no explanation for the difference in the bearings any more than we can offer an explanation for the fact that from several brands of babbitt of practically identical analysis from different manufacturers we secure varying degrees of service. There is something more than the chemical ingredients of a babbitt metal that determines the quality.

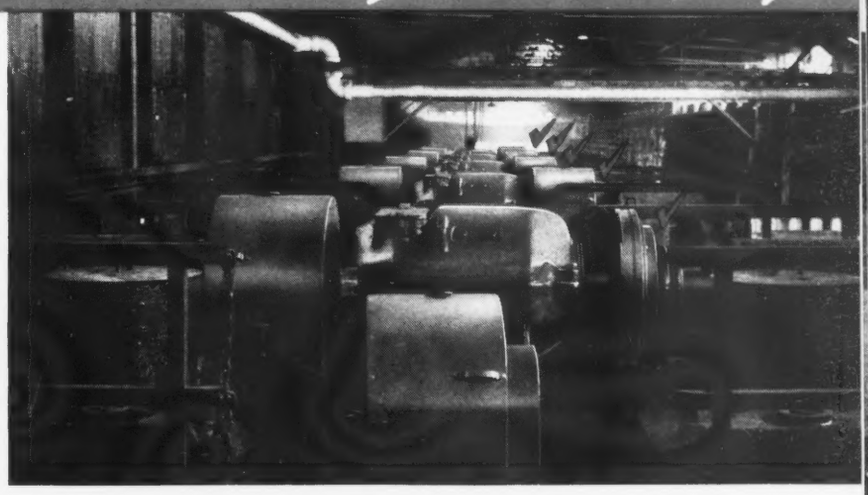
Our experience with bearings poured with a mixture of virgin and reclaimed metal has not been too satisfactory. Realizing that the matter of using reclaimed metal presents positive difficulties, we have adopted the practice of using virgin metal for bearings receiving most severe service and those which involve the largest expenditure for renewing, and using reclaimed metal for other bearings. If the stock of reclaimed metal gets too large, it is used instead of virgin metal and any additional trouble experienced is taken on

(*Continued on page* 120)

For Speed and Efficiency

LIFT, TURN, STOP, SORT *Magnetically*



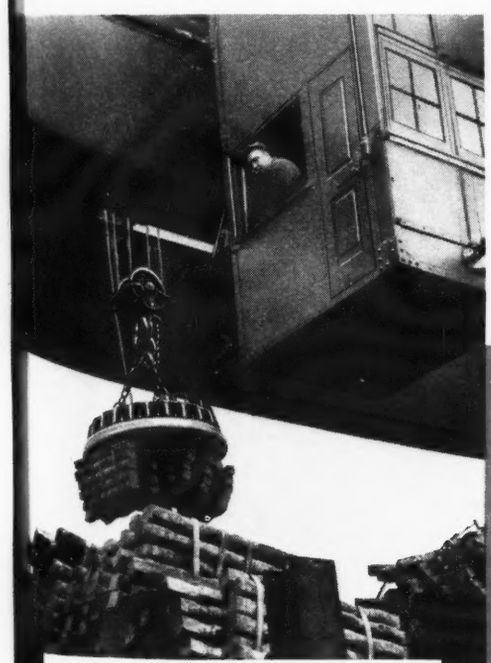


Stops them "dead"

Where machines must be stopped—quickly and without shock, jar, or damage, use a Cutler-Hammer Magnetic Brake . . . controlled by a push button or any automatic contact arrangement. Action smoothly cushioned magnetically, operation is positive and assured. For hoists and cranes in steel mills, and marine service—in fact wherever loads are to be "held" or machines "stopped." Ask a Cutler-Hammer Engineer.

Smooth and automatic starts

To start and stop machines smoothly, automatically, investigate C-H Magnetic Clutches. All mechanical clutch functions, many *extra* advantages. Remote control by simple relay and push button. Provides automatic machine operation where space is at a premium, or speed relationship is fixed. Wide range of sizes.



Protection that never sleeps

Cutler-Hammer Magnetic Separators remove stray pieces of iron and steel from valuable raw materials in many manufacturing processes, and prevent contamination of chemicals, foodstuffs or many other substances in process. A valuable ally in salvaging scrap iron from slag dumps, garbage, etc. Always on the job, protecting your machines from damage and demoralized production. If stray iron is a problem in your plant, let a Cutler-Hammer Engineer help you out.

Mountains of Iron and Steel Moved Fast

Whether you want the world's largest lifting magnet, a hold-down magnet, a slab-turning magnet or a tiny 5 inch hand magnet, you get maximum metal handling and use from a C-H *Supermagnet*: handle scrap, rolled strip steel, hot castings, gun barrels, tubes, bagged or boxed parts, etc. Ask a Cutler-Hammer Engineer.

Electro-Magnetism obeys your commands instantly and is the easiest of all energy to control. So put this speedy and obedient servant to work increasing production for you...smoothly clutching and declutching giant machines, starting and stopping parts of machines in automatic cycles, making molehills out of mountains of steel and iron, or protecting valuable materials against stray bits of scrap iron. Cutler-Hammer Magnetic Clutches, Brakes, Separators and Lifting Magnets are the product of a half century of specialization and their dependability is world famous. CUTLER-HAMMER, Inc., 1358 St. Paul Ave., Milwaukee, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

Made by the makers of

CUTLER-HAMMER
MOTOR CONTROL
C-H

1892-1942 50th Anniversary

(Continued from page 118)

the chin; but we prefer this practice rather than mixing the metals.

Pittsburgh, Pa. C J WYROUGH

Poor Lubrication May Be the Cause

IN ANSWER TO ORW'S QUESTION as to whether it is good practice to reuse babbitt from old bearings by heating the old babbitt and adding new metal in small quantities, I would like to say that it is not good engineering to form such a habit. In an emergency it is all right, but should never be done if a sufficient quantity of new metal is available.

Adding a small amount of good metal to the old every time a bearing runs too warm removes a certain amount of life or resistance from the babbitt metal. When the resistance of the babbitt is lowered, an extra-heavy load on the machine or shafting will cause the babbitt to heat. If the load is continued for any length of time, regardless of the amount of oiling or cooling, the bearing metal will wipe. This means that a portion of the bearing life is removed, as the bearing did not consist of a perfect metal originally.

The oil on this particular job may not be suitable; another possible reason for the breakdown of the bearings. When bearings are not lubricated with the proper oil the resistance of the bearings breaks down, because the oil film between shafting and bearings does not have proper heat resistance. It may not be all babbitt trouble, because ORW says in his question that some of the bearings are giving trouble from overheating and wear. The trouble could also be caused by incorrect clearance between shafting and bearings, or misalignment of the bearing shells or pedestals.

Knowing how to pour bearings is a job in itself; many persons are not qualified because they do not understand the actions of the metal when overheated. Knowing the proper temperature to heat the babbitt and shell, and the treatment of shafting or mandrel to produce a good job is necessary for good rebabbitting of bearing shells.

Philadelphia, Pa. W T MULLEN

Using New Babbitt May Prove Least Expensive

IN ORW'S QUESTION on remelting babbitt from old bearings, I think that the small cost in doing the job properly with good metal is cheaper in the long run. It will be a good check on whether the fault is actually in the babbitt or in the oil on bearings that are overheating and wearing.

I do not believe the grooves are causing the trouble, but this can be checked with the bearing manufacturer. A rough shaft, wrong clearances, and insufficient or improper lubricating oil on these bearings may be the reason for failure. According to reliable sources, bearing service depends on the way babbitt is heated and poured; if it isn't poured properly it won't last long.

Adding a small amount of good metal to remelted babbitt metal is like adding cream to water, the portion of added babbitt is so small that the efficiency and resistance qualities of this metal is reduced and its benefits lost.

It may not be advisable to reuse metal melted out of a bearing when relining or rebabbitting the shell. New metal should be used, since repetitive melting of the metal may burn out the tin, mercury and calcium, unless care is taken to avoid excessive stirring. Contamination of the alloy with other foreign metals should be prevented.

Philadelphia, Pa.
T F CUNNINGHAM

Use Care in Mixing, Pouring

ORW STATES THAT SOME of his rebabbitted bearings fail, so we can assume that the remainder continue to give good service.

The word babbitt covers a large and varied combination of metals. There are the lead- and tin-base alloys which have entirely different characteristics. Each of these different bases are divided into many different combinations of the alloy constituents and it is readily apparent that mixing different grades of the metal together will result in a poor bearing metal.

Although it has been recommended that new babbitt should not be mixed with old, it is further recommended that when this mixing is done not less than 50% new metal should be used. This recommendation takes for granted that the old metal has the same mixture as the new. Lead-base babbitt is generally recommended for light service and tin base for heavier or pounding loads.

The metal structure is affected by the melting and cooling; overheating will change the structure, therefore overheated metals should be discarded. Antimony hardens the metal and forms hard crystals in the softer matrix, improving the alloy as a bearing metal. If this element is burned out by overheating, a poor bearing will result. Repeated meltings of lead-base alloys will cause brittleness from oxidation. This can be prevented to some extent by keeping the melted babbitt covered with a layer of powdered carbon or charcoal.

When melting babbitt stir it to prevent the heavier metals from settling to the bottom. Overheating the bearing shell and mandrel will lengthen the cooling time and also allow the heavier metals to settle.

Recommended pouring temperatures apply to the babbitt in the ladle unless the babbitt pot is near the bearing. The ladle should contain sufficient babbitt to fill the bearing with one pour, regardless of the bearing size.

Chicago, Ill. W RELLEF

Better Cooling for Gas-Engine Cylinders

Answers to May Question 2

WE OPERATE A NUMBER OF NATURAL GAS ENGINES, *in which the incoming jacket cooling water has an average temperature of 55 F. The discharge water is thermostatically controlled for a temperature of 160 F. With this arrangement the bottom and top cylinder jacket temperatures are approximately equal to the incoming and discharge water temperatures. We believe that this temperature difference causes injurious and unequal expansion of metal parts. If we install circulating pumps how many gallons per minute per horsepower should be circulated to even the temperature and what hookup and controls should we use?*—OAB

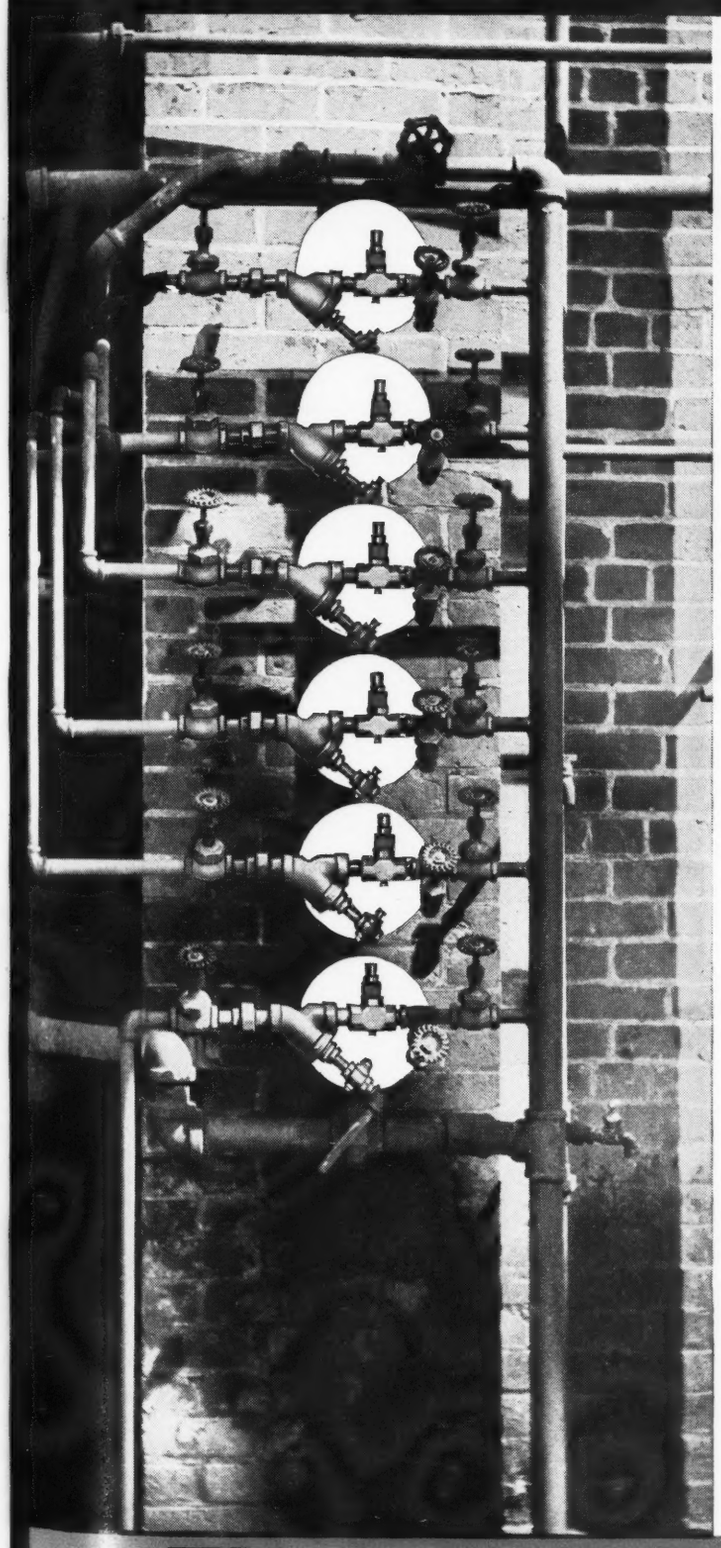
Use Inductor For Mixing

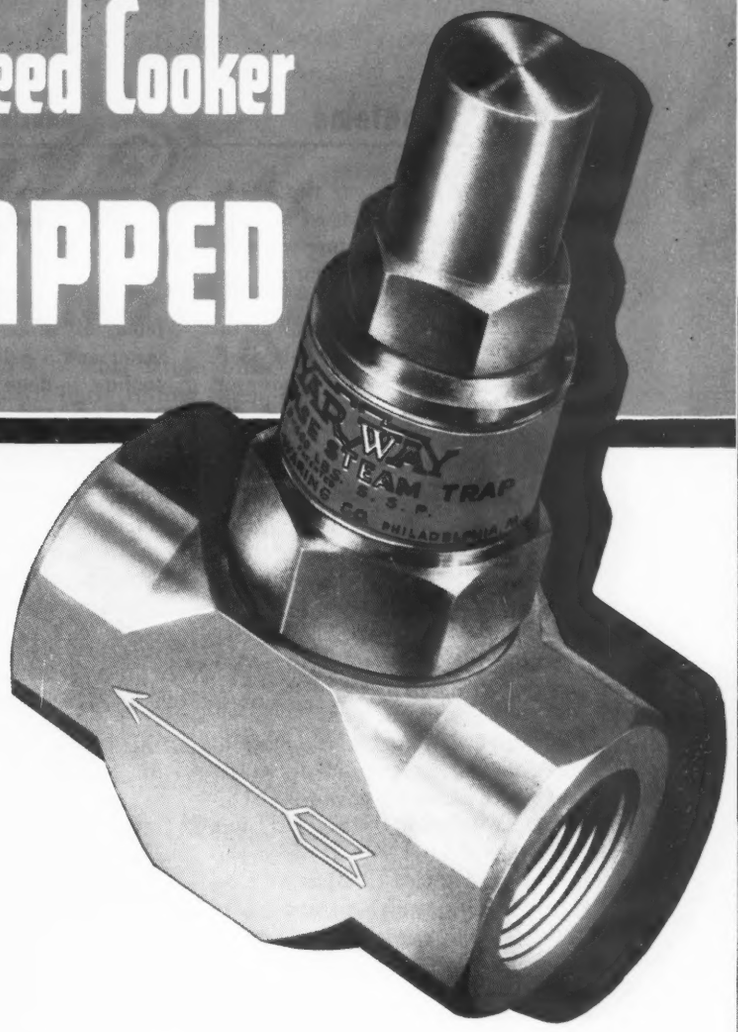
FROM OUR EXPERIENCE with diesels (and there is little difference between a diesel and a gas engine as far as cooling is concerned) we know that a temperature range of 105 F between the inlet and outlet water is far too high. It is bad enough with a single-cylinder unit but it is worse with a multi-cylinder engine. The rate of flow through the engine at such a high temperature range is entirely too small. Equal proportioning between the cylinders is almost impossible and periods of air binding with no flow at all are likely to occur, resulting in overheating and seizures.

About six years ago we had a problem

(*Continued on page* 122)

World's Largest Cotton-Seed Cooker is YARWAY TRAPPED





SIX YARWAY Impulse Traps and Strainers handle the big job of draining the heating coils of this six-high continuous cooker—largest ever built—at Magnolia Provision Co., Houston, Texas.

Ideally suited to the service—providing *continuous discharge on heavy condensate loads*, during heating-up periods, and *intermittent operation on light loads*—Yarway Traps answered this manufacturer's problem, completely.

Not only for *quicker heating* and *greater sustained heating efficiency*; but for many other distinct advantages—Yarway Traps are replacing less efficient, less dependable devices in many plants.

Have you investigated this trap about which users say,—"*saves fuel*,"—"*saves space*,"—"*easier and cheaper to install*,"—"*we like its flexibility on different pressures*,"—"*saves maintenance trouble and expense*,"—"*cheaper to replace with Yarways than to repair old-type traps*," etc., etc.

See your local mill supply distributor or write for Bulletin T-1736.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia, Pa.

YARWAY IMPULSE STEAM TRAP

 (Continued from page 120)

similar to OAB's with our two 200-hp engines. City water was used for cooling and the outlet temperature was thermostatically controlled. During the summer months, with the incoming water at 80 F, it was not bad, as the temperature range was then only 55 F. During the winter months, however, with the incoming water at 35 F, the temperature range was 100 F, with the result that piston seizures were frequent.

We then installed a recirculating system, shown in the sketch, for each engine, reducing the range to 20 F. Being very effective, simple to install and inexpensive, it has worked without trouble during six years of nearly continuous operation. Piston seizures were eliminated by its use.

A small centrifugal pump takes the hot water from the outlet before it reaches the thermostat and discharges through a check valve, to prevent short circuiting cold water in case of pump failure, then through a cock which permits easy and accurate adjustment for the proper amount of hot water, to an eductor where the cold water enters and mixing takes place. The temperature of the mixture can be checked periodically in the well shown in the cut below. No other controls are required because once the cock has been set, the mixture will hold a fairly even temperature over a wide load range.

With a range of 105 F a gas engine requires about 5 gal per hphr. The range should be reduced to at least 30 F and under these conditions 105/30 $\times$ 5 = 17.5 gal per hphr must be circulated, of which 12.5 gal will be hot water and 5 gal cold. Since the actual cooling is done by the water entering at 55 F and leaving at 160 F the amount used at present will remain the same regardless of how much is circulated through the system. One factor which must not be overlooked with such an arrangement is that pressure of the incoming cold water must exceed the pressure of the outgoing hot water.

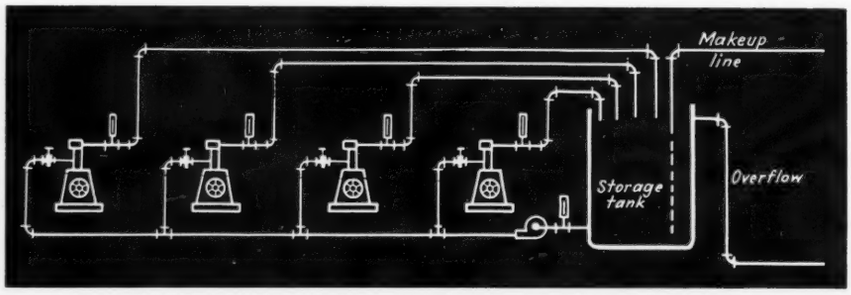
Branford, Conn. G C W GOLEM

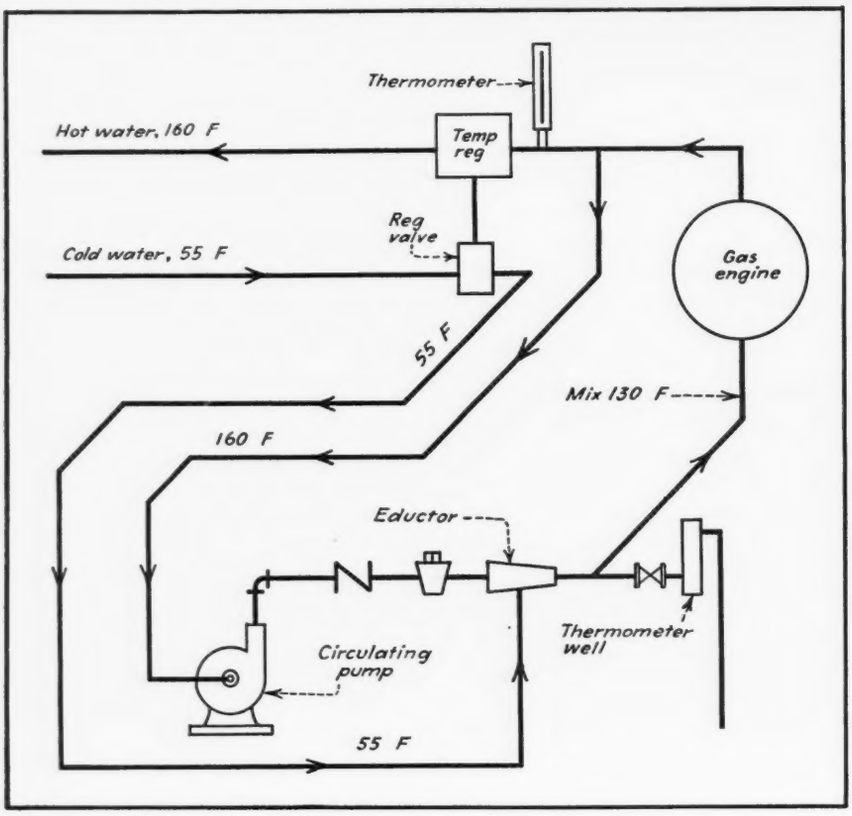
Temperature Differential is Detrimental

CERTAINLY A 105-DEG TEMPERATURE differential is too great and OAB is correct in his assumption that such difference is detrimental. The cooling water may penetrate into the combustion chamber between the cylinder head and cylinder block causing incomplete combustion or failure. In my past experience and various experiments with multi-cylinder engines using 1040–1100-Btu natural gas as fuel, 110 F inlet and 130 to 140 F discharge temperature was the most advantageous temperature difference based on consideration for lubricating-oil consumption. For his convenience OAB can determine the amount of cooling water required from data sheet No. 112 (see POWER, December, 1941, pg 126).

Perhaps OAB would consider a natural-circulation system which does not require a pump but needs an increase in inlet and outlet pipe size. It also necessitates a large storage capacity with float control in the make-up line.

Air is inexpensive; perhaps a bank of parallel-connected automobile radiators will help solve his problem. On one occasion I utilized a discarded upblast refrigeration indoor evaporative condenser for our 370-hp engine.





According to the short description given I presume that OAB's engines do not have the pumps attached and that he is using well or city water. I should like to add a sketch of an installation which will be very low in initial expense as shown above.

Schenectady, N. Y. CARL BACHMANN

Demands Positive Circulation

IN SOME DESIGNS the water jackets are made to have the inlet and outlet at the same end of the cylinder; in others the inlet enters at the top, or high-temperature end with the outlet at the bottom; still others have the inlet at the bottom and outlet at the top, the chief object being circulation and heat transfer.

However, as this case demands a more positive circulation, it should be a rather simple matter to install a cir-

(*Continued on page* 124)

Triple Threat...

TO SCALE AND CORROSION

SYMBOLIC of this triple threat are the three endless belts shown here, rolling night and day to carry Nalco chemicals on the first lap of their journey to keep thousands of the nation's power plants operating at maximum efficiency.

Nalco moves forward against scale and corrosion with three main spearheads of attack: 1. *Field Surveys* by competent engineers who review conditions in your plant; 2. *Laboratory Research* by skilled technicians who analyze your water conditions and formulate the most effective treatment; 3. *Production of Chemicals* to meet your needs by men capable of translating laboratory formulae into carload shipments.

For water treatment to best meet your individual requirements, write today for a Nalco Survey of your plant.

NATIONAL ALUMINATE CORPORATION

6222 West 66th Place • Chicago, Illinois

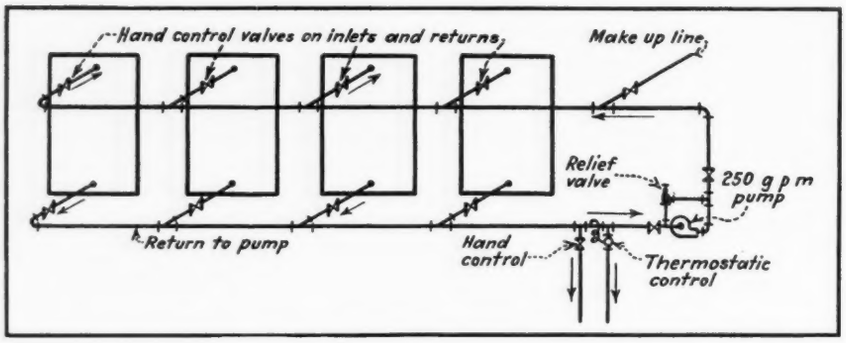
Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Avenue, Toronto, Ontario

culating pump as shown in the sketch. Discharge from the pump feeds the inlet end of each cylinder and the outlets lead to the return or suction line of the pump. The flow of water to each cylinder can be controlled by inlet and outlet valves on these lines adjusted according to demands. The high-temperature discharge can be automatically or manually controlled as desired through the thermostatic valve or hand-operated valve to the drain. This hookup is reliable for a single unit or battery of engines.

The makeup water from the city line is connected to the engine supply; in this way any loss is made up automatically. To eliminate any tendency to pump against the city pressure a relief valve is fitted as shown and set to relieve at a few pounds over the city water pressure.

When only one unit is used it may be necessary to control the discharge pressure by throttling the suction or discharge on the pump. In case of the pump failure the city water can be used in emergency and the inlets and outlets adjusted to the desired temperature.

Kearny, N. J. GEORGE MCNALLY



Recirculate Part of the Hot Water

IT IS EVIDENT that OAB has an operating condition that should be corrected immediately. The course he must take depends a good deal on the supplies he has on hand, what he can make up, and the possibility of obtaining priority rating for the purchase of any materials. No doubt this present set-up is an open-flow system of cooling water circulation, and as no diagram is given of the cooling-water-system piping, no specific changes to any particular spot can be pointed out.

The remedy for his problem lies in recirculating some of the hot water discharged from the engines after it has done its cooling work. Since he is using thermostatic control of maximum discharge water temperature, he possibly has a spare thermostatic control valve on hand that may be suitable for use, as set up in the accompanying sketch. I have assumed various conditions of piping layout, etc, but this will give the method of solving his problem which can be adapted to his own particular setup. Miscellaneous valves have been left out of the sketch.

This hookup should not entail too much additional piping, and when so installed will also make it possible, in case of emergency, to change back immediately to the full open-flow system by opening only one valve. He has not given the horsepower of his units, so the number of possible circulating pumps cannot be given. However, he should have at least two for a normal maintenance and changeover emergencies, etc. With any number of pumps, they should all discharge into a common line leading to the pressure-release and thermostatic-control setup.

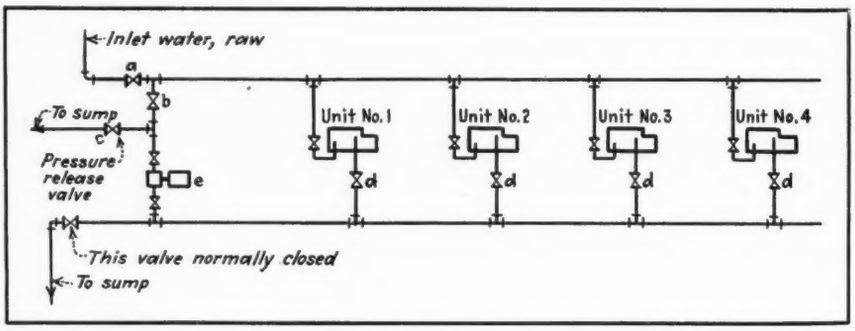
He should not have more than a 40-deg differential between the inlet and discharge water temperatures, and it should be somewhat less than that. The smaller the differential between temperatures, the more gallons per hphr in circulation will be needed. If he desires to hold the differential to approximately 40 deg it will require from 6 to 7 gal per hphr of cooling-water circulation. If he desires to hold the differential relatively close, he will require from 10 to 12 gal per hphr.

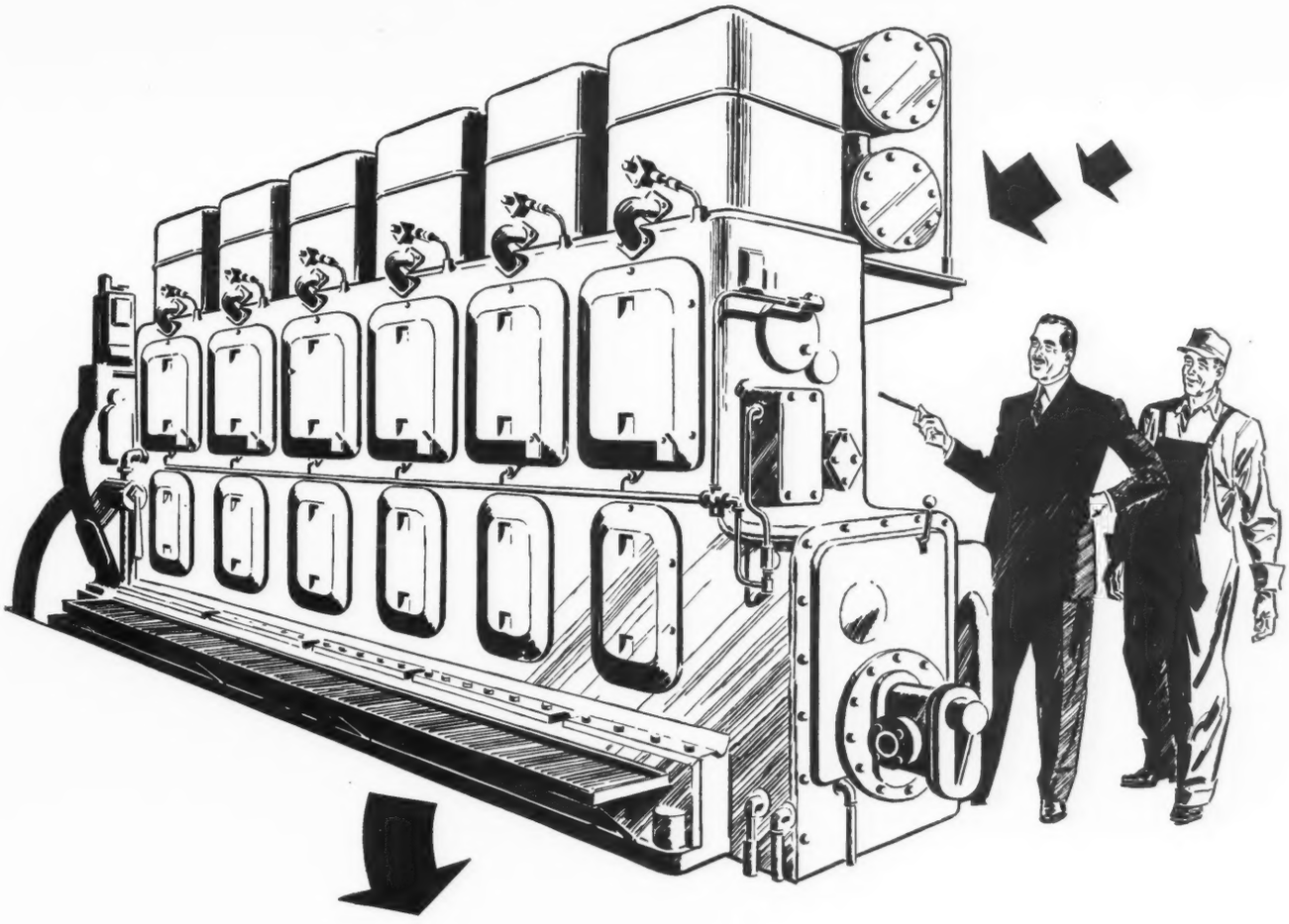
In the hookup shown in the diagram the operation would be thus: Incoming raw water would be controlled by thermostatic valve *a*, thence through the inlet lines to the engines, the discharge water temperature being controlled by the thermostatic valves *d* on each individual unit, as already installed. The 160-F hot water leaving the engines is picked up for circulation by pump *e* and discharged toward thermostatic control valve *b* which is set according to the differential desired. The valve *b* will close at 140 F, which closing will build up the discharge pressure from pump *e*, and for which pressure release valve *c* is set to open a few pounds above normal operating pressure. When valve *b* closes on the rise of the cooling water to the set point, increased pressure opens valve *c* and water is discharged to drain sump. Thermostatic valve *a* is set for opening at 120 F, and through the combination of the valves *a*, *b*, *c*, and the circulating pump *e* the temperature can be controlled very closely. The exact temperature setting of the valves *a* and *b* cannot be given but must be set according to temperature differential desired on the engines. The usual check valves must be installed on the discharge side of the circulating pumps.

Winslow, Ariz. J F MAHER

✦ ✦ ✦

What are your problems? If you face a tough operating or maintenance problem and are undecided as to the best solution, send it in to Readers' Problems. Power readers, engineers with a valuable background of experience in every phase of power generation and use can be depended on to give practical suggestions and helpful advice.





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For low cost power in stationary service installations, De La Vergne Diesel Engines have an outstanding record of economical operation and maintenance the country over.

De La Vergne has built diesel engines for practically every application. They provide unfailing low cost power in ice plants, industrial and commercial plants, textile, cotton oil, and flour mills, public buildings, hotels, and colleges. Recent statistics on one De La Vergne Diesel installation showed a maintenance cost for replacement parts of 5c per horsepower per year over a ten year period.

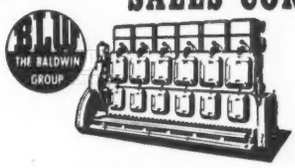
De La Vergne Diesels are engineered and designed to meet individual requirements. Ranging in size from 200 bhp to 1,500 bhp, these 4 cycle diesel engines feature sturdy, simple construction, long life, and unusual quietness of operation.

The knowledge and experience gained in 49 years of diesel engine manufacturing is built into every De La Vergne Diesel. Whatever your power requirements, regardless of the type of service, it will pay you to consult De La Vergne.

BALDWIN

De La Vergne

SALES CORP.



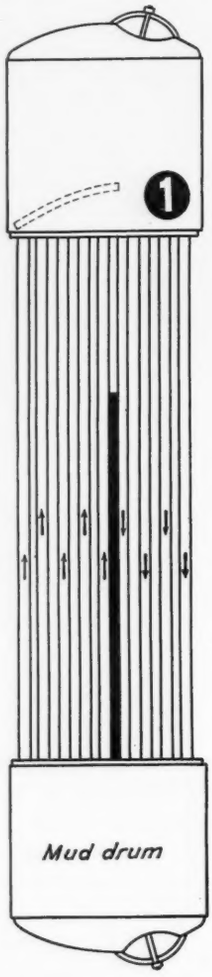
SUBSIDIARY OF THE BALDWIN LOCOMOTIVE WORKS • PHILADELPHIA

SHORT QUESTIONS QUICK ANSWERS

All Around The Plant

Q—How does the water circulate in a Wickes vertical watertube boiler?

A—The water travels upwards in the front bank of tubes and down in the rear bank, Fig. 1.



Q—In what respect does the Gunboat boiler differ from a Scotch boiler?

A—The Gunboat boiler is a modification of the Scotch design to provide a boiler of smaller diameter for use where headroom is limited. By placing the tubes on the opposite side of the combustion chamber from the furnace flues, the boiler diameter is greatly reduced but its length is doubled. The reduced diameter enables the shell to be made of thinner plates. The combustion chamber has twice the depth of the Scotch boiler and contains vertical tapered tubes which connect the upper and lower parts of the water space. They also serve to stay and strengthen the flat surfaces of the combustion chamber. Flue gas passes from furnace to combustion chamber and then to boiler tubes without reversing direction of flow.

Q—How should a gage glass attached directly to a boiler be tested?

A—Close the steam connection and blow out the glass through the drain cock. Close the cock, open the steam connection, close the water connection and reopen the cock. If either connection does not blow freely, it indicates that the sluggish connection is obstructed. The obstructed connection should be cleaned, as a false level and damage to the boiler may result.

Q—Where should a compound steam gage be used?

A—A compound steam gage is one graduated to 30 in. of vacuum at the left of the zero and in psi to the right of the zero. The gage is used for any service where either vacuum or pressure may be encountered, such as on low-pressure heating boilers, suction connections of certain pumps, some feedwater heaters, and on heating systems.

Q—How are safety valves adjusted?

A—By loosening the locknut on the spindle and tightening or loosening the bolted head on top of the spindle. They should not be adjusted more than 10% above or below the rating of the spring. A greater change requires a new spring and adjustment by the manufacturer.

Q—How does the water circulate in a sectional boiler?

A—The water travels upwards along all surfaces exposed to furnace temperatures and downwards along the surfaces exposed to room temperatures.

Q—How may the tubes of a Seabury boiler be cleaned?

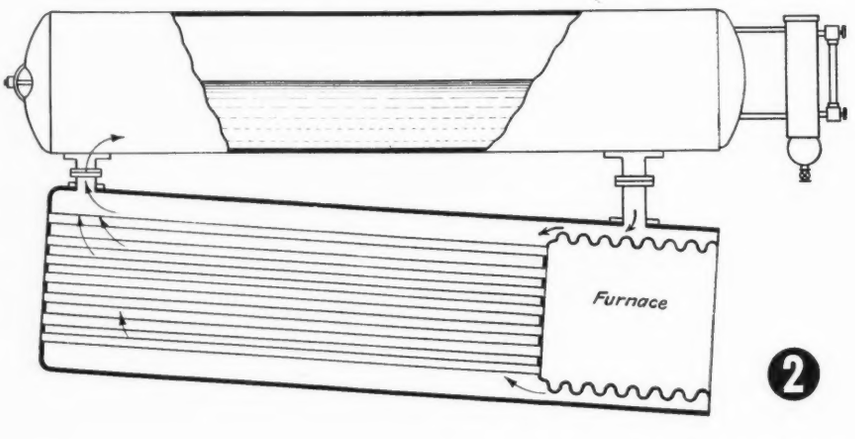
A—The tubes of this boiler are very small, about 1 in. in diameter and as the boiler is a bent-tube unit, the turbine-type rotary cleaner can not be used. Usually the most practical way of cleaning tubes is to boil out the boiler at atmospheric pressure with a strong solution of caustic soda for 24 to 48 hours. After this flush each tube with a high-pressure stream of water. It is preferable to use pure water as feed for this boiler.

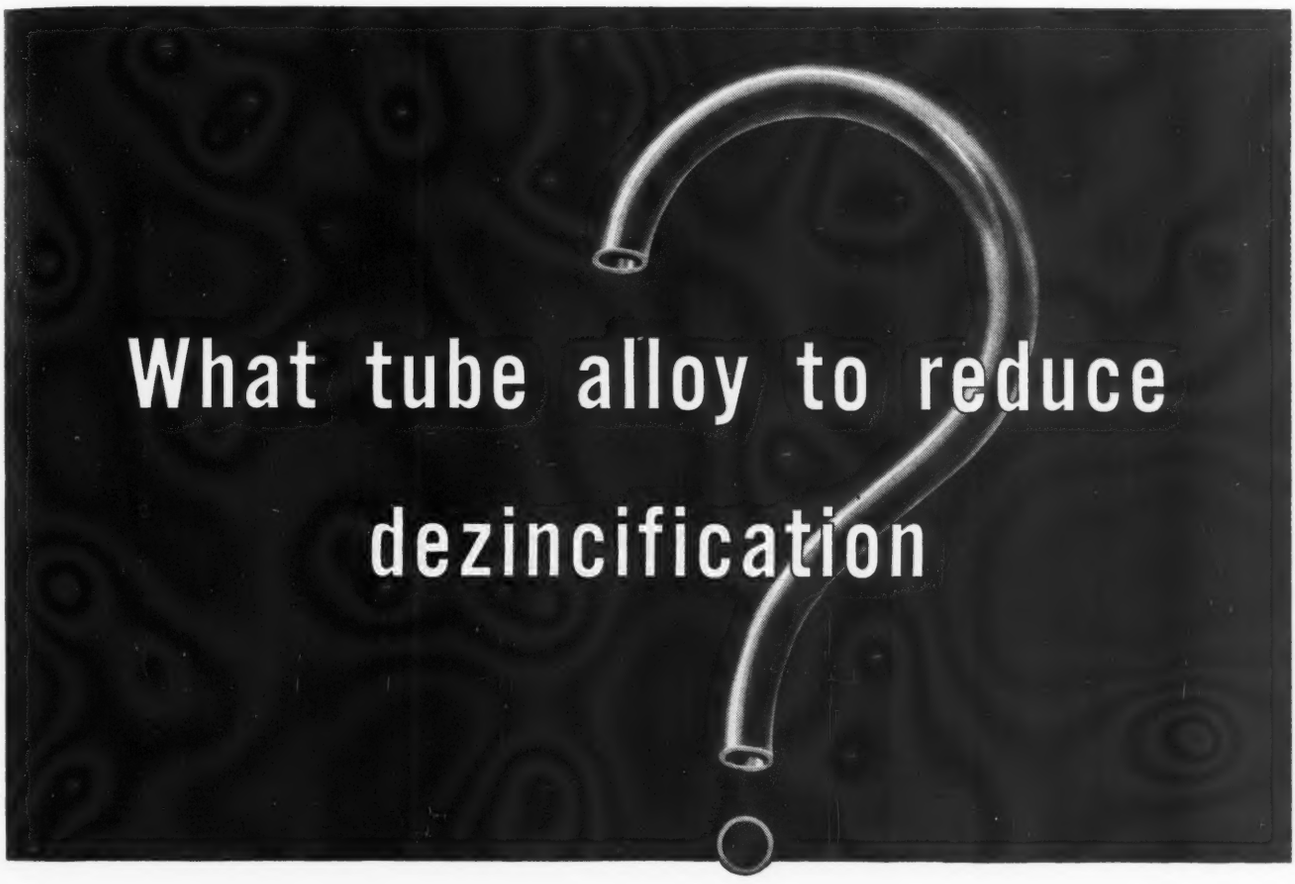
Q—What design feature in an Almy boiler should be specified to be assured of dry steam?

A—A dome containing a steam separator on the steam drum should be specified.

Q—How does the water circulate in a Robb-Mumford boiler?

A—The water circulates upwards in the lower shell around the furnace and up between the tubes, passing through the rear neck to the steam and water drum. The water passes down through the front neck and circulates downwards around the lower shell, Fig. 2.





Our *ARSENICAL ADMIRALTY*

may well be the answer to your problem

OVER ten years ago our research indicated that a small percentage of arsenic in the standard Admiralty Alloy would materially increase its resistance to dezincification.

We produced tubes of this modified Admiralty Alloy in 1934. Since then, installations in practically every type of service have proved consistently satisfactory.

While Anaconda Arsenical Admiralty Condenser Tubes have been quite generally used, they are especially well-adapted to those installations in which the older alloys showed definite tendencies to dezincify.

TECHNICAL SERVICE AVAILABLE

It is a function of the engineers of our Technical Department to assist Condenser Tube users in the selection of the most economical tube alloy for any given set of operating conditions. Please feel free to call on us. Publication B-2, sixth edition, gives up-to-the-minute data on Anaconda Condenser Tube and Head Plate Alloys. A copy will be mailed to you for the asking.

ANACONDA
from mine to consumer

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury, Connecticut

Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., New Toronto, Ont.

POWER LINES

L H Gilmer Presents Practical Plan of Power Saving Reports Results Already Achieved in Own Plant

From its own experience in meeting increased war loads, the L H Gilmer Co of Philadelphia has initiated a nationwide plan of power conservation aimed at reducing waste of power and power services by means of organized systematic surveys of plant conditions that result in leaks and losses. The L H Gilmer Co, manufacturers of power-transmission equipment, have set up their plan to include all phases of power and steam generation and use.

Some power savings made in the company's own plant, typical of what might be made in other manufacturing industries, include such items as the replacement of obsolete motors and installation of static condensers, a change that has already improved the power factor to about 95%. Reinforcing electric feeders to one of their buildings has saved 7 kw in lighting.

Results, according to John H Krauss, president, have been achieved by appointing a special staff from among the several Gilmer departments to make recommendations for any necessary modifications to plant and operations in the cause of reduced power consumption. For example, this committee recommended the purchase of a 5-hp recirculating pump with a collecting sump to handle cold-water returns. This relatively inexpensive change saves half the power consumption of a 24-hr 7-day 30-hp well pump. A reduced maintenance cost of the pumping system has also been accomplished.

Elimination of friction losses in a number of previously unsuspected places, including a survey of the plant by one of the large oil companies, has resulted in a power saving. An added dividend was realized in reducing to less than half the lubricant types that had to be carried in stock. One machine was redesigned with consequent replacement of a 15-hp motor by a 5-hp unit.

Regulation of certain process steam lines and fuller utilization of exhaust steam for winter heating have reduced the load on the boiler plant, reports Superintendent Richard Case, and have effected a real saving in coal used.

The program was used throughout the plant and individuals were appointed to check daily for possible leaks or other failures on all steam, air and water lines, valves, traps and gages.

A printed report containing suggestion blanks for several departments concerned with power generation and utilization is available on request from the L H Gilmer Co.

Power Show Advisory Committee

The Advisory Committee for the 15th National Exposition of Power and Mechanical Engineering has recently been announced. Irving E Moultrop is again chairman of the committee and John H Lawrence is vice chairman. Other members include Comfort A Adams, E G Budd Mfg Co; Homer Addams, past president, American Society of Heating and Ventilating Engineers; J T Barron, vice president electric operation, Public Service Electric & Gas Co; R E Dillon, vice president production and engineering, Boston Edison Co; E O Eastwood, president, American Society of Heating and Ventilating Engineers; A C Fieldner, chief mechanical engineer, U S Bureau of Mines; N E Funk, vice president engineering, Philadelphia Electric Co; Wm R Hainsworth, president, American Society of Refrigerating Engineers; David Myers, consulting engineer; Joseph Pope, vice president, Stone & Webster Engineering Corp; Arthur L Rice, editorial director, *Power Plant Engineering;* Charles F Roth, manager, exposition; A Bowman Snavely, chief engineer, Hershey Chocolate Corp; E K Stevens, associate manager, Exposition; Philip W Swain, editor, POWER; Alfred Vaksdal, plant engineer, Corning Glass Works; and Horace W Wilds, past national president, National Association of Power Engineers.

The Power Show management an-

(*Continued on page* 168)

NAVY "E" AWARDS

The following companies, according to information received this month, have been awarded notable distinction and have been presented with the Navy "E" award, for excellence of performance in the fulfillment of naval ordnance contracts.

AMERICAN LOCOMOTIVE CO. Company cited June 3, 1942. (Renewal; Flag first awarded in Nov. 1941.)

BUSCH-SULZER BROS DIESEL ENGINE CO. Award presented May 8, 1942.

DE LAVAL STEAM TURBINE CO. Cited June, 1942.

FOSTER WHEELER CORP. Award presented May 12, 1942.

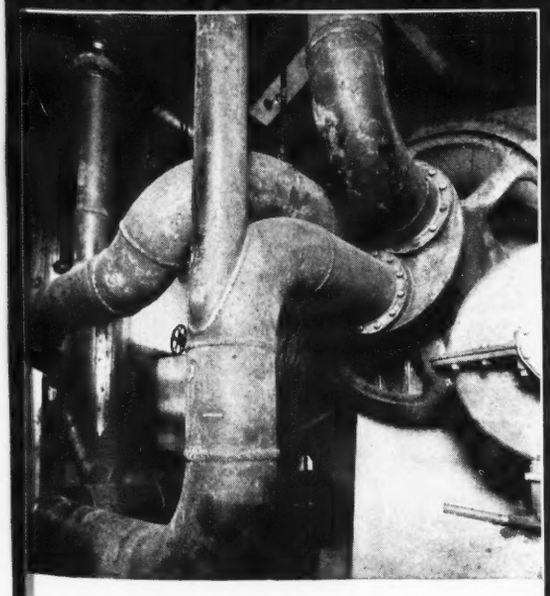
JEFFREY MFG CO. Award presented May 12, 1942.

NORDBERG MFG CO. Award presented May 18, 1942.

On June 2 the 11 drum gates, 135 ft long by 28 ft high on top of Grand Coulee Dam were lowered and for the first time a sheet of water 1650 ft wide flowed over the spillway. This water tumbled down for a total drop of over 360 ft, more than twice the height of Niagara Falls and marked the completion of the dam, on which construction started in December 1933. Last year the first 150,000 hp unit went into operation. The spillway shown in photo has a capacity of 1,000,000 cu ft of water per sec. Flow at the dam has been as low as 17,000 sec ft, and floods have reached 725,000 sec ft, with an annual runoff of 80,000,000 sec ft *Press Association Photo*

Constant jams at the turns upset piping systems, too!

WELD WITH TUBE-TURN FITTINGS TO SOLVE TOUGH PIPING PROBLEMS



In this process industrial plant, the double problem of complete protection against leakage and other possible piping failures plus the necessity of a compact piping layout, is easily solved with Tube-Turn welding fittings. Tube-Turn fittings offer the advantages of greater strength and safety, faster installation, less weight, less pressure loss, less space occupied, and a full line of fittings for every welding piping need.

Tube-Turn Welding Fittings protect your piping where it counts most!

At a roller derby, people rush to get seats near the turns for the thrills are there! It's at the turns where the speeding skaters bunch up and try to cut off opponents—it's here where crowding the turns means trouble. The same hazard exists in piping systems at the turns, for pressure and strain are proportionately increased wherever flow direction is changed. That's why welding with Tube-Turn fittings is the best possible protection against piping failures occurring where the danger is greatest—*at the turns.* There is a Tube-Turn welding fitting for *every* piping turn!

Write for helpful Tube-Turn data book and catalog.

TUBE TURNS, INC., LOUISVILLE, KY. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Tulsa, Houston, Los Angeles, Washington, D. C. *Distributors in all principal cities.*

TUBE-TURN TRADE MARK — The FIRST WELDING FITTINGS 1ST AND STILL THE BEST — *Welding Fittings*

POWER PIPING offers a special service

ENGINEERS' BOOKSHELF

Plane Trigonometry

PLANE TRIGONOMETRY MADE PLAIN—1942. *By Albert B Carson, Instructor of Mathematics, Louisiana State University. Published by American Technical Society, Drexel Ave at 58th St, Chicago, Ill. 389 pages, 5½x8 in., 198 illustrations, cloth binding. Price $2.75.*

Many power engineers find themselves handicapped when they come to deal with alternating current and other problems dealing with angles because of a lack of the simple fundamentals of plane trigonometry. This book was written to meet the needs of such men. The author discusses the essentials of plane trigonometry in greater detail than in most textbooks. A large number of figures and illustrative examples are included that are designed to further help the student visualize the how and why of trigonometry. Many typical problems are given to show the student the practical use of the subject in its own field. This text is suited to home study by those who want to obtain a working knowledge of plane trigonometry as well as for use in classrooms.

Safety Valves

STEAM FLOW THROUGH SAFETY VALVES —1942. *Engineering Experiment Station Bulletin No. 110. By Eugene K. Falls. Published by Ohio State University, Columbus, Ohio. 106 pages, 6x9 in. Tables, charts and diagrams. Paper cover. Price $1.00.*

This work is an extension of the original safety valve researches made by Professor Bucher at Ohio State, in cooperation with the National Board of Boiler and Pressure Vessel Inspectors.

With the backing of leading manufacturers of safety valves and the National Board of Boiler and Pressure Vessel Inspectors, Mr Falls has investigated the flow of steam through a variety of safety valves under many different conditions.

Army Engineers

WHAT THE CITIZEN SHOULD KNOW ABOUT THE ARMY ENGINEERS—*By Lt Col Paul W Thompson. Published by W W Norton Co, 70 Fifth Avenue, New York, N. Y. 210 pages, maps, illustrations, cloth bound. Price $2.50.*

It has frequently been pointed out how the gasoline motor has changed the face and form of war, has counterbalanced the weight of the machine gun, and has restored movement and the offensive to the battle line. Less readily discernible, but equally as vital, are the factors which *enable* the motor to function. Here we enter the province of the hardy soldier, the engineer.

Specifically, this is the story of the Corps of Engineers of the U. S. Army starting from the beginning of the Corps up to the present moment. The story follows the Corps through all of its more important functions, equipment and weapons, involved. Case studies from recent action in Europe supplement the running description.

Written for the average citizen, the volume makes the functions, actions and importance of the Corps fascinating reading.

Civilian Defense

WHAT THE CIVILIAN SHOULD KNOW ABOUT CIVILIAN DEFENSE—*By Walter D Binger and Hilton H Railey. Published by W W Norton Co, 70 Fifth Ave, New York, N. Y. 183 pages, cloth bound, illustrations. Price $2.50.*

"To the civilians of the British Isles, whose mass gallantry has not been surpassed in the whole chronicle of mankind." Thus reads the dedication on this book covering civilian defense, "everybody's business." A distinguished engineer who has made an extensive professional study of the subject, including a month in wartime England, has collaborated with an authoritative writer on military affairs to produce this volume dealing with civilian problems arising out of enemy action.

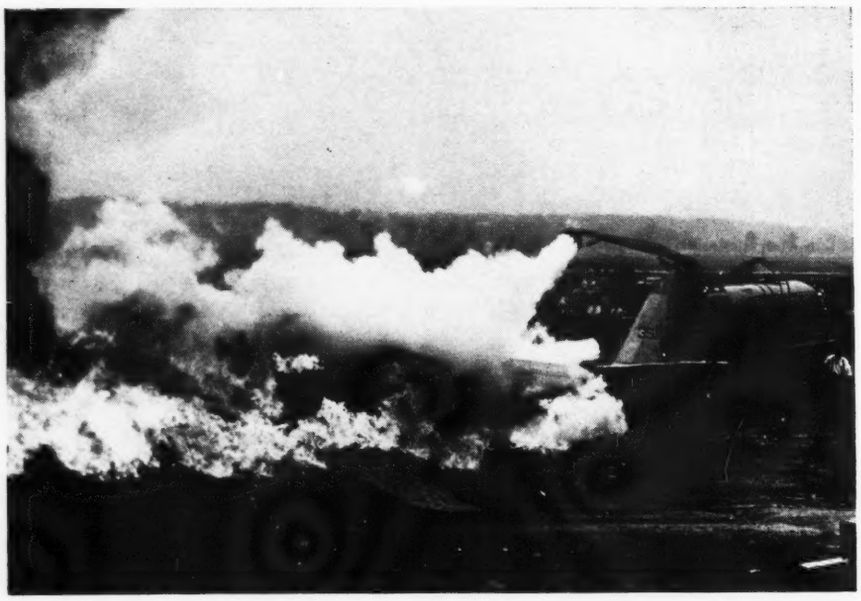
The background of British experience has been utilized fully and adapted to our own problems of the skyscraper, utilities, industrial plants, as well as "the great open spaces". The book will give the reader a fundamental concept of aid raids and their consequences which will forearm him for whatever may be in store.

Oil Burners

OIL BURNER HANDBOOK — *By L J Whelan, Published by Master Plumber & Heating Contractor Magazine, 554 Atlantic Ave, Brooklyn, N. Y., and distributed by Landan Book Co, 16 East 17th St, New York, N. Y. 245 pages, cloth bound. Price $2.50.*

A practical man's handbook of domestic oil burner design, installation and troubles ten brief chapters on

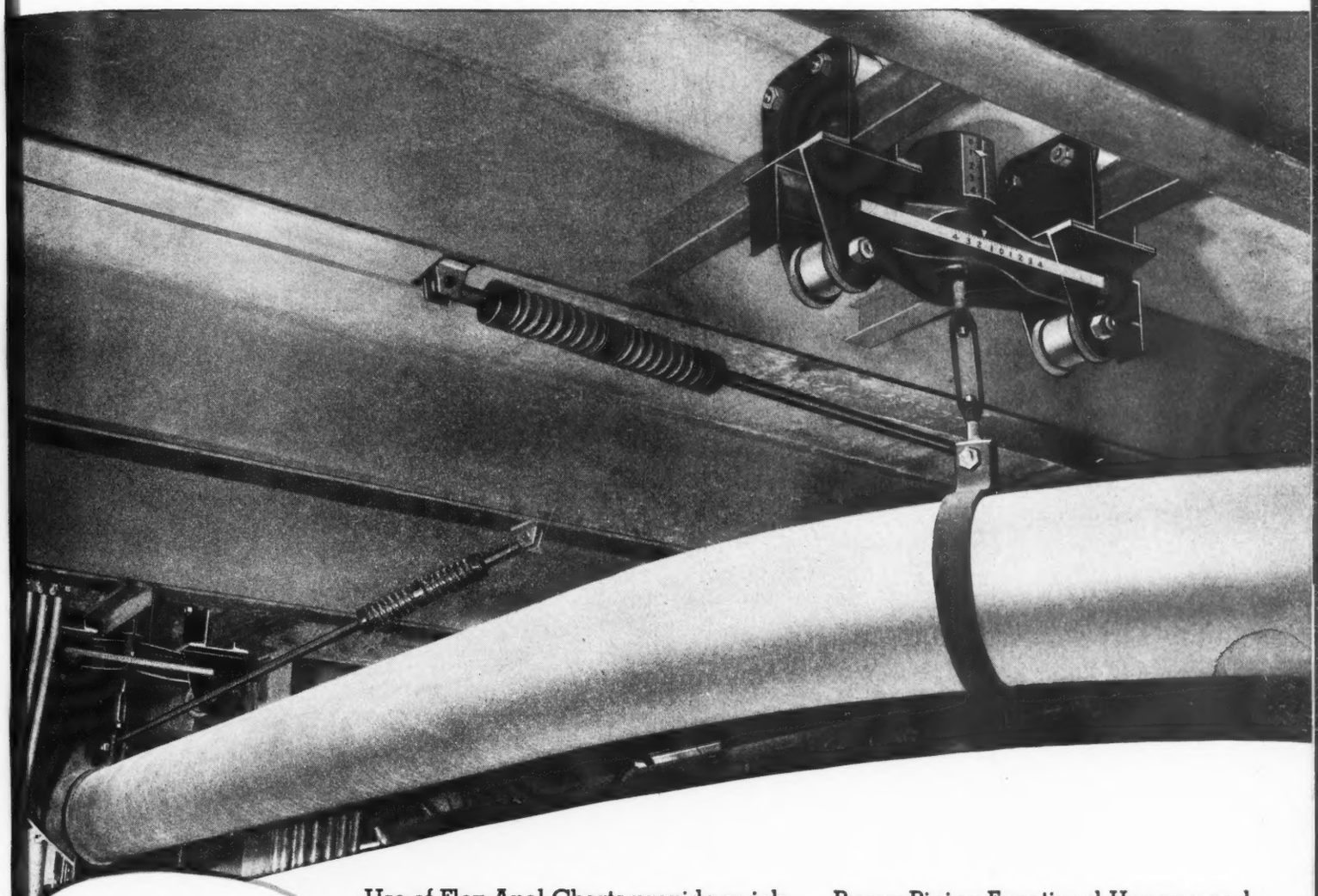
(*Continued on page* 144)



With all front nozzles shooting, the airport crash truck swings into action against a burning airplane (set on purpose, just for the test; but it could happen anywhere) and in a few moments the flames are out, driven back by a wall of carbon dioxide. The occasion is the demonstration of the new air force crash truck, a Cardox development. An ancient airplane wreck was deliberately set afire and allowed to burn furiously for 90 seconds before the firefighting equipment was summoned. Photo shows the flames being driven back by the CO_2, which coats the surrounding ground and plane surfaces with carbon dioxide snow

fittings for every welding piping need.

POWER PIPING offers a special service in DESIGN, PREFABRICATION, ERECTION of PIPING SYSTEMS



DESIGN

PREFABRICATION

ERECTION

PROTECTION

Use of Flex-Anal Charts provide quick methods for obtaining simplified piping layouts incorporating minimum physical dimensions for any given design specification: Economical and efficient.

Prefabricated sub-assemblies, heat-treated and stress-relieved, under exact engineering control, are delivered to the job. This means extreme accuracy and a negligible amount of field welding.

Piping systems are erected by shop trained erection crews with modern tools and precision equipment under capable supervision. This means maintenance of all schedules.

Power Piping Functional Hangers and Vibration Eliminators facilitate erection as well as measure and control the behavior of any piping system.

It is emphasized that Functional Hangers and Vibration Eliminators protect piping systems against shocks occasioned by violent extraneous forces including seismic disturbances. Piping systems are thus enabled to function even in the presence of abnormal movement of building steel, are cushioned against shock which would normally cause disruption of the system and are insured against failure due to metal fatigue.

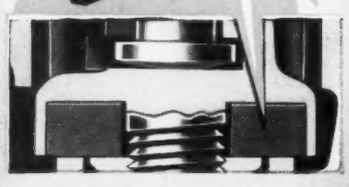
The correlated use of FLEX-ANAL CHARTS AND HANGER BULLETIN No. 1815 saves time in engineering man power which can be devoted to other useful purposes. Copies of these books can be obtained by requesting them on your business letterhead.

BLAW-KNOX COMPANY
POWER PIPING DIVISION

1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

"Double the Watch"

1 WATCH THIS!



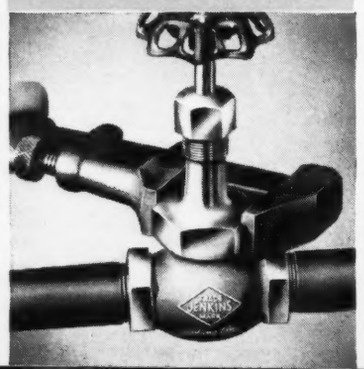
Replace Worn or Damaged Discs QUICK! IT'S EASY

DISC HOLDERS READY LOADED

A Keep extra disc holders loaded with Jenkins Discs recommended for your services. Then you are ready to make replacements in the minimum time because disc holders are reloaded in spare time.

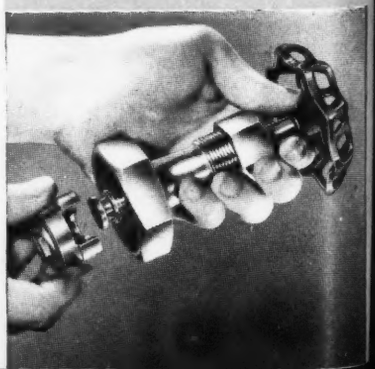
BONNET QUICKLY REMOVED

B Apply a hex or monkey wrench to the bonnet and unscrew. By raising the spindle a turn or two you will prevent the disc holder from falling off the spindle.



SLIP OFF OLD—SLIP ON NEW

C Now turn the spindle until the disc holder slips off in your hand. Slip on the holder containing the new disc—return the trimming to the body, for "good as new" service.



on Valve Discs and Packing!

TODAY IT'S MORE IMPORTANT THAN EVER—

To Replace Discs and Packing Before Leaks Can Cause Interruption of Vital Production Jobs*** To Take the Simple Steps that Make Them Last Longer...to Conserve Scarce Materials!

Leaky valves can waste power, consume man-hours, interrupt production. Leaky valves can destroy themselves . . . and valves are scarce!

A few leaky valves in *your* plant may not seem important. But, multiply that small waste by thousands of plants and buildings, and you have a major handicap to the war effort! You have always been on the watch for leaks. Today, it's important to "double your watch" . . . to prevent valve leaks *before they start.*

A large share of your valves probably have Renewable Composition Disc seats. These valves are easiest to keep tight. It's simple to know when the seat or packing box is about ready to leak. And, it's simple to replace the Renewable Composition Disc, or to refill the packing box. Do it *in time!*

STOP WASTES OF DISCS AND PACKING! They are made of scarce rubber, plastics, asbestos, brass. There are many ways to maks discs and packing last longer. Here are some pointers worth reading:

★ PRACTICAL POINTERS THAT SAVE DISCS — PACKING ★

1 — When installing pipe or valves, be sure interiors of both are clean; that threads are clean; that joint compound doesn't enter valve. Foreign matter often damages discs.

2 — Install valves with spindle in upright position whenever possible to insure tightness.

3 — When operating conditions are very severe, or workmen fail to apply sufficient effort on the handwheel, install valves with inlet pressure *above* the seat. In ordinary services, it is satisfactory to have pressure *beneath* the seat.

4 — Before disassembling a valve, put the disc in open position to prevent damage.

5 — To avoid cutting valve seats, replace the disc as soon as leakage begins.

6 — See that disc nut is tightened sufficiently to hold the disc in place but not too tight.

7 — Do not apply extra leverage or a wrench to wheel when ordinary effort fails to close valve tightly. Inspect the seats – see if proper type disc is used; if seat ring needs refacing or regrinding.

8 — After closing a hot valve, follow up handwheel when valve cools. Contraction may lessen force on disc, permitting small leaks of steam that cut the seat.

9 — For Jenkins Valves, a special disc nut – Throttling Nut – is available for throttling service. It costs little, saves discs when valves are in throttling service.

10 — Most important, *use the correct composition disc* for the service. Don't expect a "cold water" composition to work well or last in hot water service. Get a copy of Jenkins folder, "Guide to Correct Usage", from Jenkins or your local Jenkins Distributor – it tells which of the many special compositions is best for the job. And, be sure to use Jenkins Renewable Composition Discs in Jenkins Valves.

11 — Keep ample packing in the packing box, and use the correct grade for the service. An asbestos packing, well graphited and lubricated, is best for general duty.

12 — Packing wears out due to heat and pressure, loses its life. Remove packing that is unfit for further service.

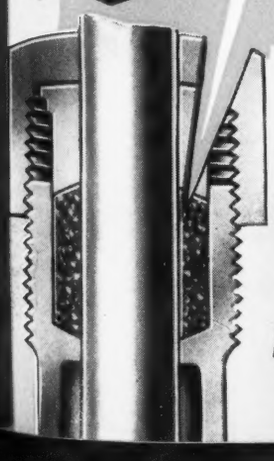
13 — Insert extra material soon after repacking a valve stuffing box to compensate for compression of packing.

14 — Consult Jenkins Engineering Service about any unusual problems of keeping valves tight.

JENKINS VALVES.. ..BRONZE..IRON..STEEL

JENKINS BROS., 80 White Street, New York; Bridgeport; Boston; Atlanta; Philadelphia; Chicago; Houston. Jenkins Bros., Ltd., Montreal; London.

2 WATCH THIS!

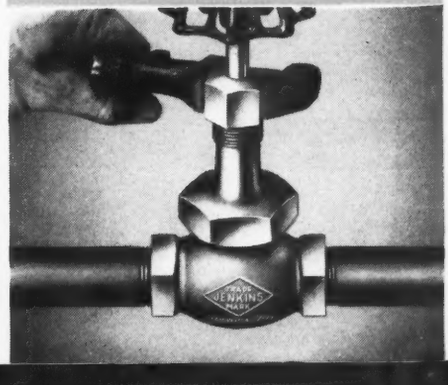


Keep ample "live" packing in packing box

IT'S EASY

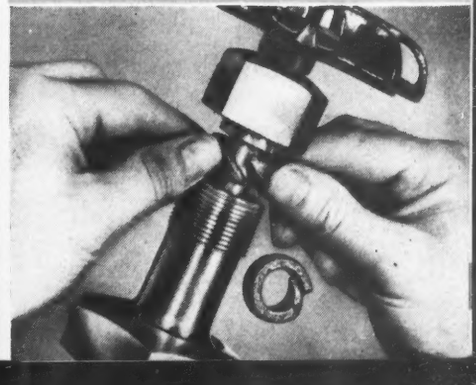
REPACK UNDER PRESSURE

A —whenever the valve is designed to permit it, to avoid shutting off the line. Open valve fully so back-seating feature can engage. Remove packing nut with a hex or monkey wrench.



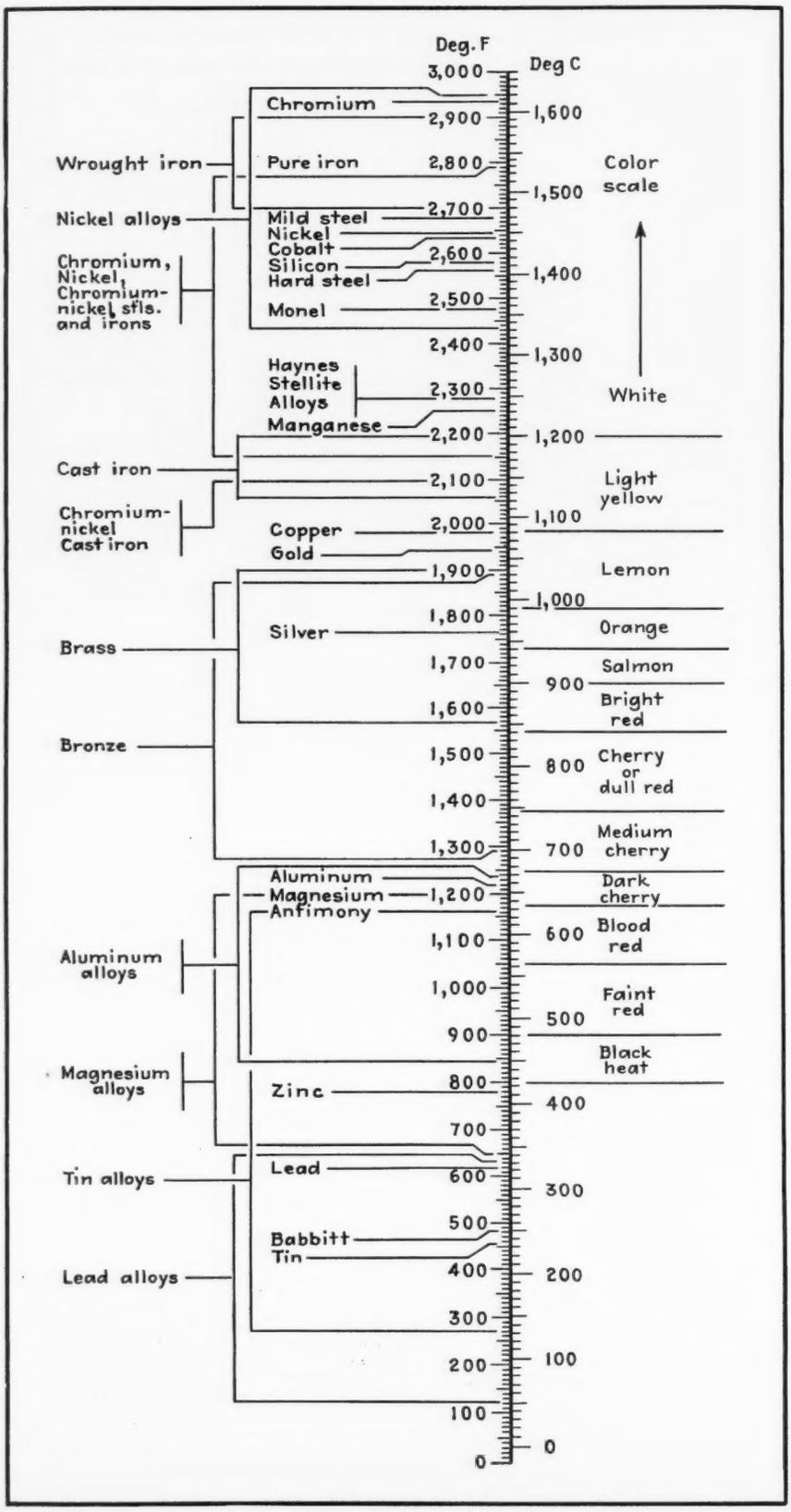
SLIP-IN CORRECT PACKING

B Ring packing is most convenient but should be molded to fit packing box. String or braided packing, graphited and lubricated, may be used. Do not pull-up packing nut too tight.



Number 119

Metal Melting Temperatures



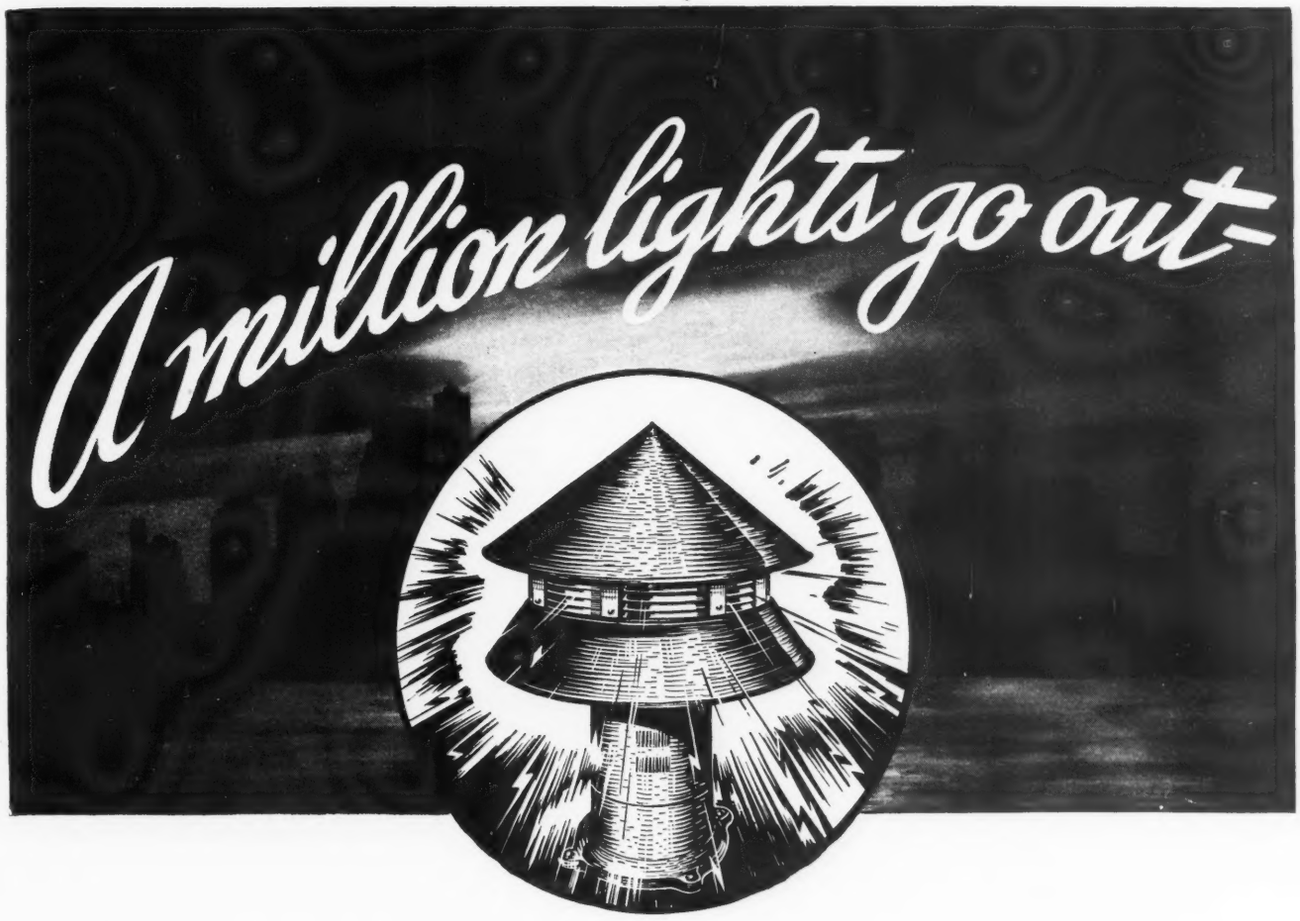
▶ BASIC INFORMATION on working with metals and alloys at high temperatures can be quickly obtained from this chart. Melting points of various metals and alloys are given in both Fahrenheit and Centigrade, and are keyed to a color scale.

Reference to the chart indicates, for example, why aluminum and aluminum alloys because of their low melting points have little change in color as they approach welding heat. Welding of wrought iron, it will be noted, requires much higher temperature than steel or cast iron.

Color chart is applicable to observations in fairly dark surroundings without welding goggles. Color scale is useful for judging welding preheat.

Courtesy Linde Air Products Co

© POWER



WHAT HAPPENS in the BOILER?

SIRENS Scream Blackout —a dramatic drop in load —a routine workout for the COPES Flowmatic Boiler Feed Water Control. Independent of any other control in the plant, Flowmatic does its one job of maintaining a safe water level at all times—takes orders only from the boiler it serves.

Over 2,000,000 H. P. of boilers in central stations, steel mills, paper mills, forge shops, refineries, chemical plants, and the like, are protected by COPES Flowmatic against water level hazards which might come from violent load changes.

Flowmatic, the two-element steam-flow type feed water regulator, keeps boiler water at the safe level, no matter what the range of steam demands. Steam-flow and water-level curves prove this fact. Bulletin 429 reproduces typical charts and illustrates installations. Write for a copy.

NORTHERN EQUIPMENT COMPANY, 721 GROVE DRIVE, ERIE, PENNA.

Feed Water Regulators, Pump Governors, Differential Valves
Liquid Level Controls, Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA · ENGLAND REPRESENTATIVES EVERYWHERE

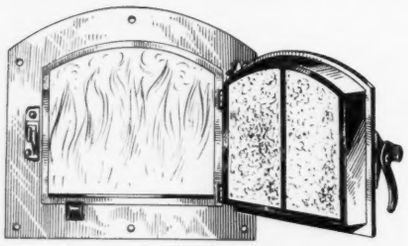
★ GET CLOSER LEVEL CONTROL WITH THE COPES FLOWMATIC ★ REGULATOR

FEEDS BOILER ACCORDING TO STEAM FLOW-AUTOMATICALLY

WHAT'S NEW IN PLANT EQUIPMENT

Furnace Door

OF HIGH-QUALITY CAST IRON, door is balanced and swings open and closes easily on heavy hinges. Locktight handle closes door tightly so that all infiltration of excess air around the door is eliminated. Door is lined at the factory with Plicast L-W-1 light-weight insulating refractory material. This lining is said to reduce the weight of door, protect metal from heat and decrease radiation of heat to boiler room. Available in right-hand opening only as shown. *Plibrico Jointless Fire-Brick Company, Trenton, N. J.*

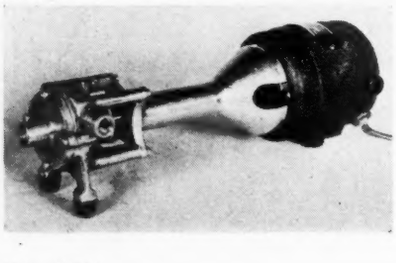


Insulating Varnish

DESIGNATED AS S-110 the varnish is for application to electrical apparatus that must operate at abnormally high temperatures. Tests have indicated that S-110 will stand operating temperatures of 250 C or higher. When baked at 175-200 C it dries through the deepest winding and does not resoften when exposed to high operating temperatures. Dried film is mechanically strong, adhesive and flexible, and retains these characteristics under adverse heat conditions. *Sterling Varnish Co, 165 Ohio River Blvd, Haysville, Pa.*

Hot-Liquid Pump

MIDGET HOT-LIQUID PUMP is compact and can handle hot liquids up to 500 F. Pump can be used in industrial, pilot plant, laboratory and experimental applications where thin liquids at temperatures up to 500 F are to be handled. It is a centrifugal pump, weighs 7 lb and is powered by 1/20 hp Universal fan-cooled motor for 115 volts ac or dc. Stuffing box is accurately adjustable by means of an easily accessible adjustment ring. Coupling motor and pump are coupled through a 5-in. head-radiating tube. Shaft is supported by outboard ball bearings. Maximum pressure on unit should not exceed 21 psi and maximum volume is 7½ gpm. *Eastern Engineering Co, 45 Fox St, New Haven, Conn.*



Limit Switch

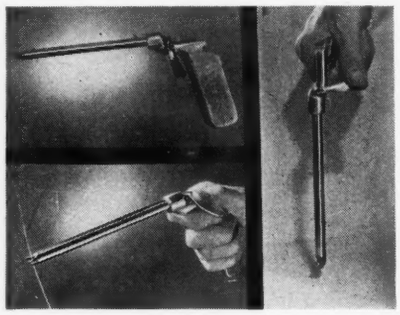
TYPE P SMALL PRECISION limit switches have been designed specifically as built-in contact mechanisms on electrical devices. Basic switch units enclosed in transparent molded polystyrene cases, sealed against tampering, yet allowing visual inspection of contacts. Operating lever can be adjusted to any position in complete circle. 15-deg travel is sufficient to operate the switch and the lever permits an additional 40-deg. emergency overtravel in either direction. A camera-shutter type toggle mechanism gives accurate operation with only 2½-oz. force applied to a lever arm. Normally open and closed circuits are insulated electrically to make unnecessary a common connection between them. *Square D Company, Industrial Controller Div, 4041 North Richards St, Milwaukee, Wis.*

Idler

SELF-ALIGNING IDLER for flat conveyor belts, both return and carrying, said to help keep the belt central on its supporting idlers. If for any reason the conveyor belt runs to one side, it has tendency to swivel idler in a horizontal plane. If this in itself is not sufficient to cause the idler to swing enough to force the belt back immediately, the belt will continue traveling to one side until it contacts the counterweighted end disk, which is slightly larger in diameter than the idler roll. Contact with the counterweight tends to rotate it, but since it is a counterweight it resists this tendency to rotate and produces a counterforce on the idler. This causes the idler to swivel rapidly, throwing the idler more out of line, which then immediately forces belt to swing back the other way. Units have no side guide rolls to impose unnecessary wear on the belt edge. *Chain Belt Company, 1600 West Bruce St, Milwaukee, Wis.*

Long-Nose Cutter Retriever

UNIT IS COMPACTLY DESIGNED to cut wire with one-handed, one-fingered trigger operation and retrieves or holds in a powerful grip nuts, bolts, washers, cotter pins, etc at inaccessible points. Unit resembles a pistol, cutting edges being located at the end of the long slim barrel. To cut wire, operator merely places wire between cutting edges at "business-end" of the pistol and snips off the wire by bringing down the trigger which actuates a rod operating inside pistol barrel. Leverage ratio is 15 to 1, and practically no thumb pressure is required on the trigger. To retrieve a bolt, nut, washer, cotter pin, etc, which may have dropped into an inaccessible place, the long-nose barrel is merely poked into the hard-to-get-at-place and trigger brought downward; the hardened steel cutters pick up the missing part. *Pack-Rite Machine Corp, 828 North Broadway, Milwaukee, Wis.*



Sealing Compound

DUXSEAL, non-hardening adhesive sealing and caulking compound is used like putty and sticks readily to any clean surface without slumping, flowing, or hardening in service, maker says. It is insoluble in water, unaffected by ordinary gases and condensates, and will not hurt hands. Formerly used for electric power and telephone companies to seal openings in ducts, now used by electricians, maintenance engineers, and for general utility service. *Johns-Manville, 22 East 40th St, New York, N. Y.*

Glass Floodlight

REFLECTING SURFACE from floodlight is shatterproof. Reflector is coated by electrolytically deposited metal, which

(*Continued on page* 154)

He'll work his head off in the plant to lick the Japs and Jerries. But he—and thousands of his brothers in industry—need help in keeping your plant *fit* for today's triple-shift production job. To provide that help—for him and for YOU—Crane Co., many months ago—established a vital new service for American industry . . . the Crane "Piping Pointers" shop bulletins.

Helpful Hints for Promise-Beaters

KNOWING HOW to choose the right valve for a particular service may make all the difference between smooth-flowing production and costly interruptions. So Crane, in "Piping Pointers" bulletins, gives practical hints on valve selection—hints that prevent piping troubles—hints on *where* and *why* and *how* to install valves and fittings for best service and long life.

WRENCHES CAN BE DEADLY enemies of production if wrongly used. Because it is so vital for piping equipment to *stay* on the job today—because piping replacements waste time as well as critical metal—these Crane shop bulletins are showing maintenance crews in thousands of plants how to give proper care to valves, fittings, and pipe lines—how to keep them on the job for Victory.

TRAINING NEW MEN to know the A, B, C's of piping maintenance—helping veteran workers to *"brush up"* on modern methods—is one of the jobs which Crane "Piping Pointers" bulletins are doing in many plants today. Subjects covered range from how to open and close valves to how to prevent water hammer—all adding up to peak efficiency for pipe lines—*and more production!*

★ **OFFERED FREE AS AN AID TO VICTORY—"Piping Pointers" are available *free*—on request—from your local Crane Representative—or by writing to the address given here.**

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE • PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

THE STRENGTH OF OUR NATION . . .

TWO men rode out from Charlestown, Mass., that historic night in April, 1775. We remember only Paul Revere, because Longfellow rhymed his midnight ride. Yet it was the other man, Major Wm Dawes, who actually got through to Concord, while Revere was caught just outside Lexington. At least as important as either rider was the friend who set the lantern—and who ran the major risk of being caught. He had to climb the spire of the Old North Church and set out "one if by land and two if by sea." He was Captain Pulling, whose name, until now, I'll bet you've never heard.

War lionizes the General MacArthurs, Captain Kellys, Lieutenant Bulkeleys, and Sergeant Leonards. And rightly so. They are the men who face sudden death day by day and night by night in order that our concept of liberty may live.

But back of them are the millions of "little" men and women who only serve, unhallowed and unsung. The other day the newspapers reported the death of a foreman. His heart had stopped beating from overwork. His job was to produce parachutes with the men and machinery that once made ladies' dresses. And he died trying, just as surely as if his heart had been stopped by an enemy bullet.

Millions of civilians are quietly doing that same kind of job—all of us who are trying to fight too, in the only way we can—by serving.

Thousands of power engineers are trying to make a boiler setting last just a few more weeks, or to get just another horsepower or two out of engines or turbines, or to make an old compressor or pump deliver just a little more a little longer. For them there are no trumpets, no flags, no glory. There is only the satisfaction of having done their best in a cause vital to us all.

These are the soldiers without guns, the little men nobody hears about, but who are among the bravest of the brave nevertheless. It is George Washington who stands highest among our nation's heroes for winning our war for freedom, but Robert Morris died penniless and unknown through financing it.

Only soldiers can win a war. We civilians cannot—but we can *lose* it. Our lagging, loss of faith, or interruptions of production, no matter how minor, are each a black mark against our cause. In the final analysis, the little men are the strength—or the weakness—of a nation. And one of our chief weaknesses right now are those among us who hoard rationed foods, who lie to get extra gasoline, tires, or strategic materials, or who betray the very concept of liberty by placing self, group or sect above country in this time of peril.

Let us—and through us our nation—be *strong!*

George Edwards

Engineer

For every industrial service there is a JOHNS-MANVILLE INSULATION specially designed to provide highest operating efficiency, long life and maximum fuel savings - - -

Here are brief facts on a few of the most widely used J-M Insulations. For full details, and for information on J-M Insulation Engineering Service, write Johns-Manville, 22 E. 40th St., New York, N.Y.

• • •

FOR STEAM LINES UP TO 600° F.—J-M 85% Magnesia Pipe Insulation. For many years this material has been proving its ability to maintain its high insulating efficiency in service. It is the most widely used power-plant insulation.

FOR STEAM LINES UP TO 700° F.—J-M Asbesto-Sponge Felted Pipe Insulation is recommended where maximum efficiency, salvage value and resistance to vibration and abuse are essential.

FOR HIGH-PRESSURE SUPERHEATED STEAM LINES—J-M Superex Combination Insulation, consisting of an inner layer of Superex high-temperature insulation and an outer layer of J-M 85% Magnesia or Asbesto-Sponge Felted. Combines unusual heat resistance and high insulating efficiency.

FOR BOILER DRUMS, WATER WALLS, FEED-WATER HEATERS, TANKS, BREECHINGS AND UP-TAKES—J-M 85% Magnesia Blocks for temperatures up to 600° F. Strong, durable, lastingly efficient.

FOR COLD-WATER LINES—J-M Anti-Sweat Pipe Insulation—a cold-water pipe insulation designed to prevent condensation and damage from dripping.

FOR REFRIGERATED SERVICE—J-M Rock Cork Sheets and Pipe Insulation—basically mineral, Rock Cork cannot rot and will not harbor vermin or support mold. It is highly moisture-resistant and retains its unusually high insulating efficiency indefinitely. Widely used for refrigerated equipment and piping, air-conditioning ducts and cold-storage rooms.

FOR FURNACE INSULATION—J-M Superex Blocks, for years the most widely used block insulation for temperatures up to 1900°F. Combines high heat resistance with low thermal conductivity.

J-M Insulating Brick (3 types) and J-M Insulating Fire Brick (4 types) for temperatures up to 2600° F. Furnished in all standard 9" shapes of the 2½" and 3" series, as well as in special shapes.

Also J-M Sil-O-Cel C-3 Concrete, cast on the job from Sil-O-Cel C-3 aggregate and cement. Sets up into a strong, durable semi-refractory insulating concrete for temperatures up to 1800° F.

DART UNIONS

HAVE LONG LIFE LINES

...To conserve vital metals put your Used Darts back to work

In these times, when the conservation of vital metals is not only important but *necessary*, you can help your Government and your plant by letting *used* Darts work side by side with *new* Darts.

You will find that the "old-timer" Darts will make up tight quickly and easily and stay tight unfailingly . . . like new Darts. The complete explanation why Darts can be used again and again with such satisfaction lies in the way Darts are made: their matched bronze seats, ground to "true-ball" surfaces; their air-refined malleable iron nuts and bodies that resist corrosion, rust and rough handling.

Yes, used Darts are "treasures" today —so "dig them up" and put them back to work. And for *new* Darts, see your supplier today.

DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

Wartime Problems

(*Continued from page 77*)

load was applied, this method might be safe. There are some indications that the change in temperature and resultant expansion caused by admission of high-pressure high-temperature steam to the low-temperature zone may cause deposits to crack off.

Some experience reports indicate that presence of CO_2 in steam, usually kept to a minimum, may help to avoid depositing. Presence of CO_2 in steam does no harm when unit is operating, but in idle machines if there is throttle leakage, CO_2 may cause blade corrosion.

Although troubles caused by deposits can be alleviated by washing and other means of removal, these are only half measures. The final answer lies in absolute steam purity, a boiler problem.

Corrosion of steel parts of turbine oiling systems when first put into operation evidently results from changes in refining which have reduced tendency to sludging and lowered the steam-emulsion number. Similar trouble has been encountered on old units when a new charge of oil has been added. Most operators seem to prefer to use the new longer-life oils and to overcome the rusting with an inhibitor. Surfaces in an oiling system may be protected with special paints during the initial period when natural inhibitors are building up in the oil or units may be started on old oil or a mixture of old and new. Presence of water seems a contributing factor and provision of air circulation at the top of the oil tank to remove some of the saturated vapor has proved successful.

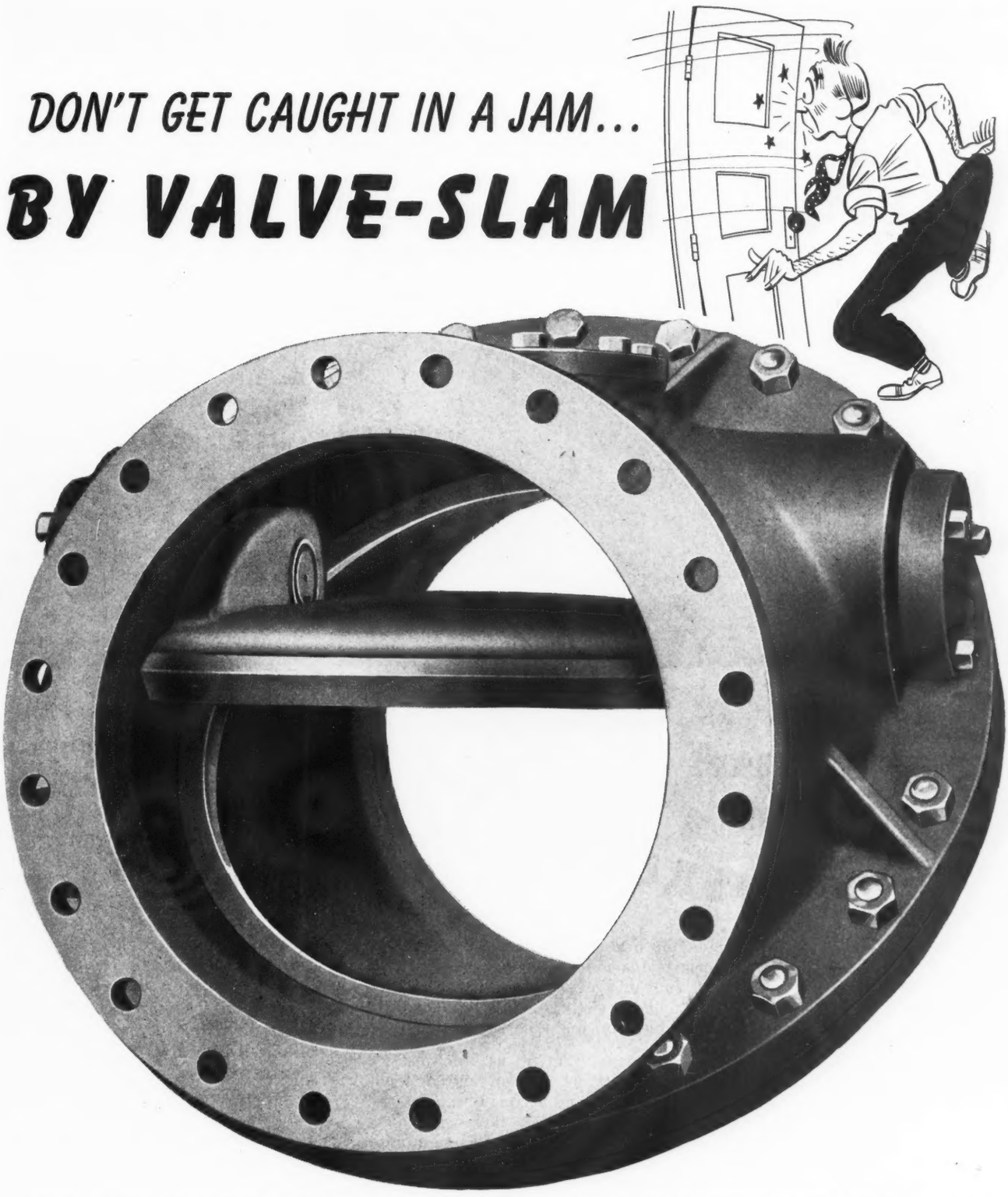
There is some feeling that too much emphasis has been placed on oil life. It may not be sound to jeopardize expensive equipment by trying to save on oil costs and it may be preferable to change oil oftener. Likewise it may prove advantageous to run at higher oil temperatures although it may mean shorter oil life and increased sludging with more frequent cleaning.

Discussion of increasing plant capacity by removing "bottlenecks" revealed that in many industries greater opportunities exist outside the power house than inside. Failure to insulate even small steam lines involves serious losses and lack of coordination in production operations may cause unduly high peaks. Educational campaigns for conservation have reduced wasteful use of power services in many plants.

In the power house, capacity gains

DON'T GET CAUGHT IN A JAM...

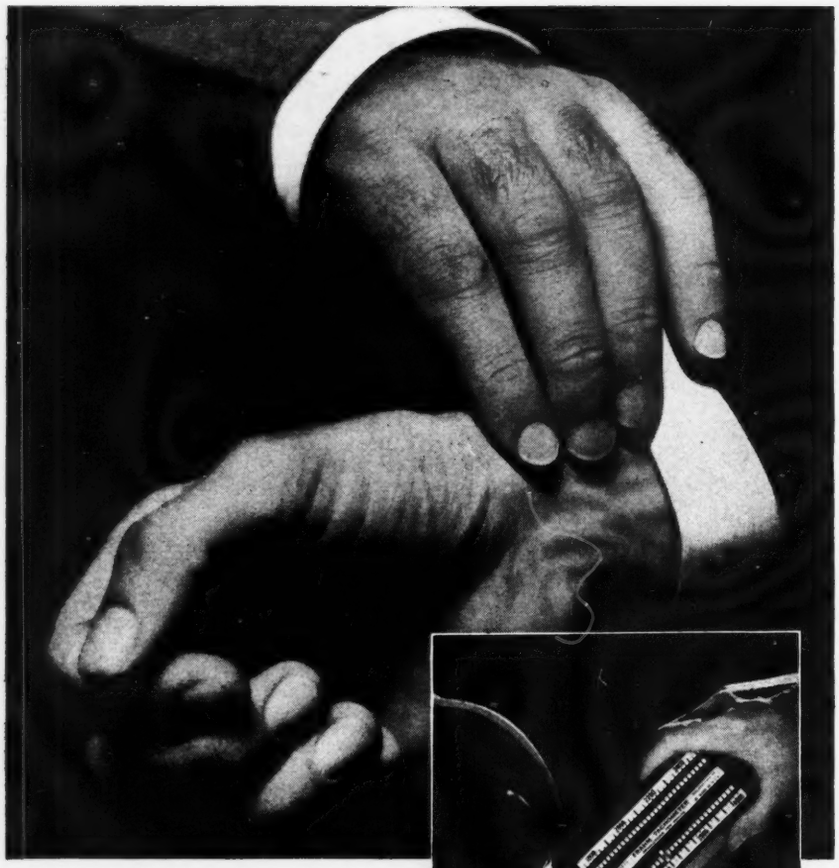
BY VALVE-SLAM



Put in Chapman Tilting Disc Non-Slam Check Valves . . . and put the *quietus* on valve-slam that causes line-damage and opened pipe-joints by vibration, surging and hammering. Chapman's tilting disc is cushioned quietly to a drop-tight seat as flow slows down . . . cutting head-loss 65 to 80%, and preventing rubbing and wear in the valve itself. Send today for illustrated 12-page book that shows how Chapman Non-Slam Check Valves are increasing operating efficiency and cutting pumping and maintenance costs for leading power plants. *Write now.*

THE CHAPMAN VALVE MFG. CO., INDIAN ORCHARD, MASS.

CHAPMAN NON-SLAM CUSHIONED CLOSING **CHECK VALVES**



You can measure speeds by TOUCH with a "FRAHM" TACHOMETER

Simply hold the Frahm Tachometer against some stationary part of a motor, turbine, centrifuge or any such machine and almost immediately one of a series of calibrated reeds begins to vibrate, and the corresponding point on the scale shows the speed.

This unique tachometer can be used to measure speed of any single rotating element, large or small, open or totally enclosed, and is equally accurate for measuring vibration frequencies. It has no pointer and no wearing parts and its factory-set calibration cannot be lost through over-speeding or lack of oil. Having no belts, gears, or electrical connections, its use imposes no load on the machine under test. Made in types for hand use and for permanent mounting in ranges from 900 up to 30,000 r.p.m. or v.p.m.

★

Write for Bulletin 1590-P which describes Frahm Tachometers of both the portable and permanently mounted types.

James G. Biddle Co.

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

can be made by step-by-step elimination of limiting factors. This may mean, for example, better coal selection to increase stoker or pulverizer capacity, installations of vanes and splitters to cut excessive draft losses, operating electrical equipment by actual temperature readings rather than by nameplate ratings and removal of flow restrictions in boiler-feed lines. Wide-spacing the first row of boiler tubes to increase radiant absorption was also suggested to lower furnace temperature, reduce slagging and increase capacity.

Putting a crew to work with water-cooled sampling tubes and orsats was advanced as a vital step in improving boiler performance. Measurements will show stratification in the furnace, point to faulty excess-air conditions in tube banks and permit burner adjustment to avoid tube wasting previously mentioned. A check on excess-air conditions can be made by analyzing slag and checking ferrous-ferric ratio.

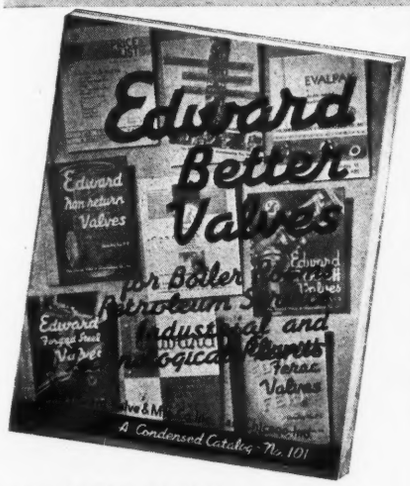
New methods of installing thermocouples in furnace tubes permit accurate measurement of surface temperature. The refinery industry uses such measurements as a guide to cracking-still operation and it was predicted that similar methods will be used to determine maximum boiler loading, just as thermometer readings are used to set maximum loads on electrical equipment. Stress was also laid on measurement of windbox conditions as an aid in correcting faulty air distribution, causing slagging or other furnace troubles.

In a session sponsored by the Fuels Division, H C Carroll, Commercial Testing and Engineering Co, outlined recent developments in use of overfire air to provide turbulence and prevent stratification, to permit increasing the heat release in furnaces of limited volume, to increase steam production economically, to reduce combustible in flyash when coal is burned in suspension and to burn refuse more rapidly and smokelessly.

An important feature of investigations to determine the nature and extent of unburned-gas losses is the substitution of an ultimate analysis for the conventional orsat readings. Mr Carroll described a portable unit designed to make ultimate analyses in the field and concluded his paper with data on several overfire-air installations.

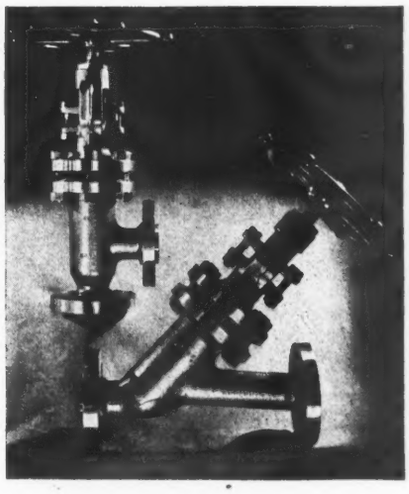
Discussion emphasized the importance of overfire air as an emergency measuse and suggested use of steam jets where fans cannot be obtained. It was pointed out that on underfeed stokers, ability to alter fuel-bed contour by pusher-stoker adjustments gives some

On these Edward Valves - - - -
DELIVERIES WITHOUT DELAY



Today, more than ever before, it pays to use the Edward valve line. On many items . . for instance those illustrated here . . Edward is making prompt deliveries on proper priorities. Concentration on standard lines, increased plant capacity, and 'round-the-clock production has made this possible.

But there has been no compromise with the Edward tradition of quality. Today's Edward valves, whether for 150 lb or 1500 lb service, are built with the same painstaking care that has made Edward synonymous with low cost in the long run. You should have full details on the Edward line in your files. Have you?



DO YOU HAVE THIS HANDY CATALOG? . .

Edward Better Valves catalog No. 101 was compiled with an eye to today's problems. Complete but condensed to save your time, this highly usable handbook of widely-used Edward valves is packed with design and dimensional data and illustrations. It's yours for the asking. Write for Edward Better Valves Catalog No. 101.

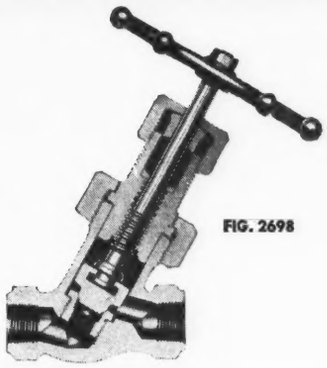


FIG. 2698

VERSATILE STOP VALVE . .

The best bet for a multitude of tough jobs —that's Edward Fig. 2698. Forged steel, inside screw, union bonnet, screwed ends. Full area, streamlined body minimizes pressure drop. EValloy seat and disk. Drop tight closure, easy operation. For 600 lb sp. at 750 F in sizes ¼ in. to 2 in. Fig. 2698 is globe, Fig. 2699 is angle. O.S. & Y. of similar design (Fig. 2688-9) also available.

BLOW-OFF EFFICIENCY . .

For tough blowdown jobs, count on Edward blow-off valves. Straightway or angle, shown above, for 150 to 1500 lb sp. Slow opening design avoids damaging shock to piping. EValloy or hard-surfaced seats and disks fight erosion and corrosion. Globe type seating design for tight closure with less leakage.

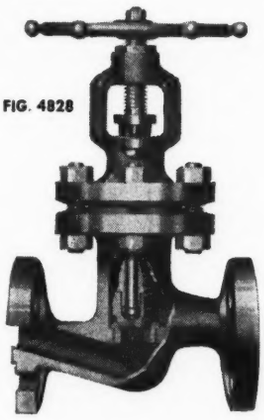


FIG. 4828

QUICK, SURE SHUT-OFF WITH EDWARD Fig. 4828 . .

Strong and reliable, Fig. 4828 is a flanged end leader in the Edward stop valve line. For pressures to 600 lb, this forged steel O.S. & Y. globe valve has bolted bonnet and bolted gland. Unique Edward swivel-plug type disk prevents galling, cuts maintenance, adds to valve life. Seats and disks are EValloy, Edward's specially developed stainless steel. Same design characteristics available in angle valves and for pressures to 1500 lb Sizes ½ in. to 2 in.

RELIEF! . . .

Edward forged steel relief valves. Relieving pressures to 600 lb for auxiliary steam lines, pump housings, heat exchangers and unfired pressure vessels generally handling water, oil or vapor. Globe or angle, screwed ends, sizes to 2 in. Stainless steel ball reseats tightly, no sticking. Vapor tight when relieving.

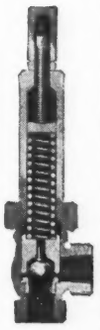


FIG. 141

INTEX STOP VALVE . . . . .

Where elevated temperatures and high velocities tend to shorten valve life, Edward Intex globe valves offer opportunities for substantial savings. The seat is integral with the body and hard-surfaced with a tungsten-cobalt-chromium alloy. Disk also hard surfaced. Socket welding, flanged or screwed ends for pressures to 1500 lb at 950 F. Unusually easy to disassemble with all working parts readily accessible.

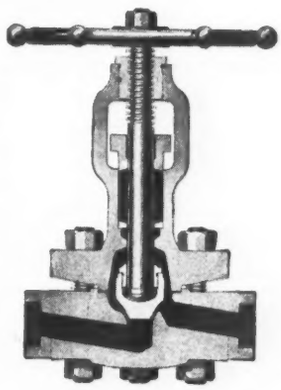
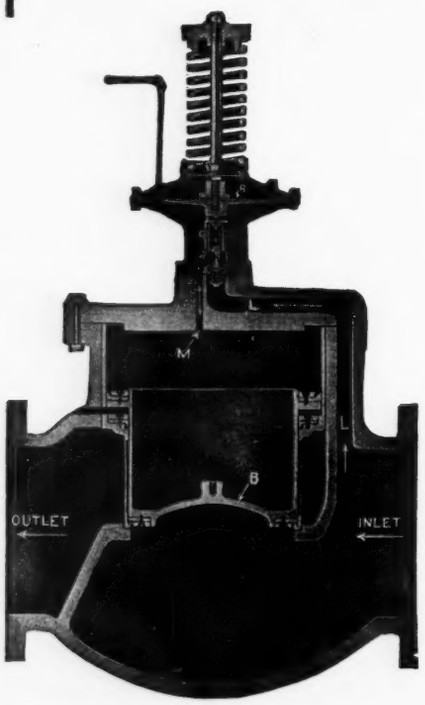


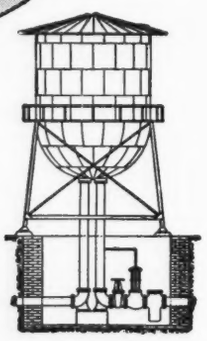
FIG. 3264

THE EDWARD VALVE & MFG. CO., INC.
1220 WEST 144th STREET • • • EAST CHICAGO, INDIANA

EDWARD *Steel* CAST AND FORGED VALVES

Golden Anderson
SPECIALTY
VALVES





ALTITUDE CONTROL

• Hold efficiency at an even level by equipping your tank or standpipe with G-A Altitude control valves. You'll get a constant, automatic water level at all times, with no overflow. This valve is positive in action, with no water or hammer shock. Comes in sizes of 2" to 36", in either globe or angle pattern. Air and water cushioned, it also includes full bronze trim with no metal contacts. Write for your free copy of the G-A catalog . . . it completely describes the entire line.

Also

Triple Acting and Non-Return . . .
Pressure Reducing . . .
Throttle and Emergency Stop . . .
Check Valve, etc.

GOLDEN-ANDERSON VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PA.

measure of control over gas distribution and mixing. Application of overfire air to an underfeed must take account of variations in the fuel bed, dependent on the operator's method of firing. Open furnaces commonly used with underfeeds usually require more penetration. On chain grates, jets have usually been placed in the front, although rear location has its advocates. Rear jets seem best on underfeeds; tangential jets have given good results on underfeeds and spreaders.

Other papers of interest to power engineers included "Spreader Stokers Applied to Marine Boilers", by Otto Di Lorenzi, Combustion Engineering Co; "Corrosion of Stressed Alloy-Steel Bars by High-Temperature Steam," by H L Solberg, A A Potter, G A Hawkins and J T Agnew, Purdue University; "The Uniform Automatic Rolling-in of Small Tubes," by F F Fisher and E T Cope, Detroit Edison Co; and "Heat Transfer and Pressure Drops in Ljungstrom Type Air Preheater," by Hilmer Karlsson and Sven Holm, Air Preheater Corp.

Engineers' Books

(*Continued from page* 130)

commercial and industrial burners written in simple English. Chapters on fuel oils, combustion, boilers, burners, installation, controls, regulations, and troubles cover most types of commercial and domestic installations. Design and care of preheaters, tanks, piping and controls are covered in well indexed chapters. This is a book that a power engineer can recommend to his friends for care of their domestic burners as well as gain a few pointers for himself.

Heat Transfer

ELEMENTS OF HEAT TRANSFER AND INSULATION—*By Max Jakob, Research Professor of Mechanical Engineering at Illinois Institute of Technology and George A Hawkins, Associate Professor of Mechanical Engineering at Purdue University. Published by John Wiley & Sons, 440 Fourth Ave, New York, N. Y. 169 pages, cloth bound, 6x9 in. Price $4.50.*

The mathematical approach to heat transfer problems has been available to most engineers only as graduate study in universities. Professors Jakob and Hawkins teach "rational" heat transfer to undergraduates and have prepared this text covering basic principles ap-

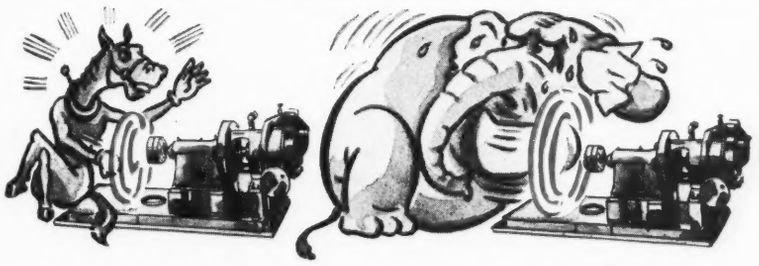
"THRU-PUT INCREASED 19%"

Perhaps there is an idea in this letter for getting more production out of *your* boilers, kilns, stills. The general manager of an oil refinery near Chicago (name furnished upon request) describes results obtained with Coppus-Dennis Fanmix Gas Burner:

"Furnace temperatures throughout are more even and savings in fuel most gratifying. We have no flame impingement whatever, and although our thru-put is much higher, we believe we have increased the life of our tubes in this heater by fully one-third."

Bulletin 410-3 will tell you about the perfect gas-air ratio and complete instantaneous combustion you get with Fanmix. Also describes famous Coppus "Blue Ribbon" design features. Check the coupon for a free copy.

COPPUS



A JOB FOR A SMALL STEAM TURBINE ... NOT EXPENSIVE ELEPHANT SIZE!

Fit the steam turbine to the job and save investment and maintenance cost. There are six frame sizes of Coppus Steam Turbines — with ratings from 150 HP down to fractional — and prices to match.

If it's a small-HP job, it's a Coppus job. And "Blue Ribbon" manufacturing (precision-built dynamometer-tested) means trouble-free performance. Check coupon for Bulletin 135-9.

COPPUS

COPPUS BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

COPPUS ENGINEERING CORPORATION

327 Park Avenue, Worcester, Mass.

Sales Offices in Thomas' Register. Products in Sweet's Catalog.

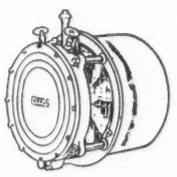
You'll get valuable ideas from these free bulletins on other Coppus Blue Ribbon Products

(Check the ones you want)

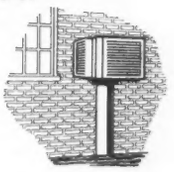
☐ Coppus Cable Manhole and Tank Ventilators. For confined working spaces. Bulletin 163-1.

☐ Coppus Boiler Manhole Blowers and Exhausters. For cooling boilers, drums, etc. Bulletin 161-3.

☐ Coppus Heat Killers. Keep production up by keeping men cool. No stale air recirculation. Air is directed. Bulletin 160-5.



☐ Coppus Type C Turbo Blower. For undergrate draft. Bulletin 145-6.



☐ Coppus Air Filters. For engines and air compressors. Perfect, uninterrupted filtration. Bulletin F-310-4.

☐ Coppus-Dennis Fanmix Gas Burner (described in this ad).

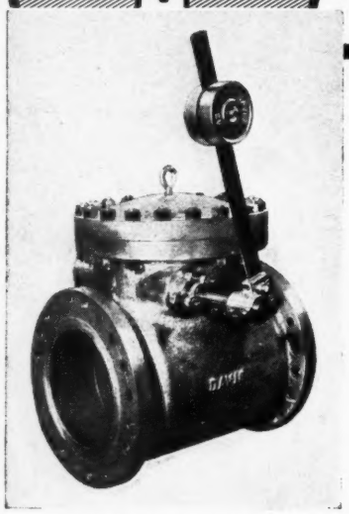
☐ Coppus Steam Turbine (described in this ad).

NAME.....

COMPANY.....

ADDRESS .....

Balanced SWING CHECK VALVES



Davis No. 134 counterbalanced swing check type non-return valve.

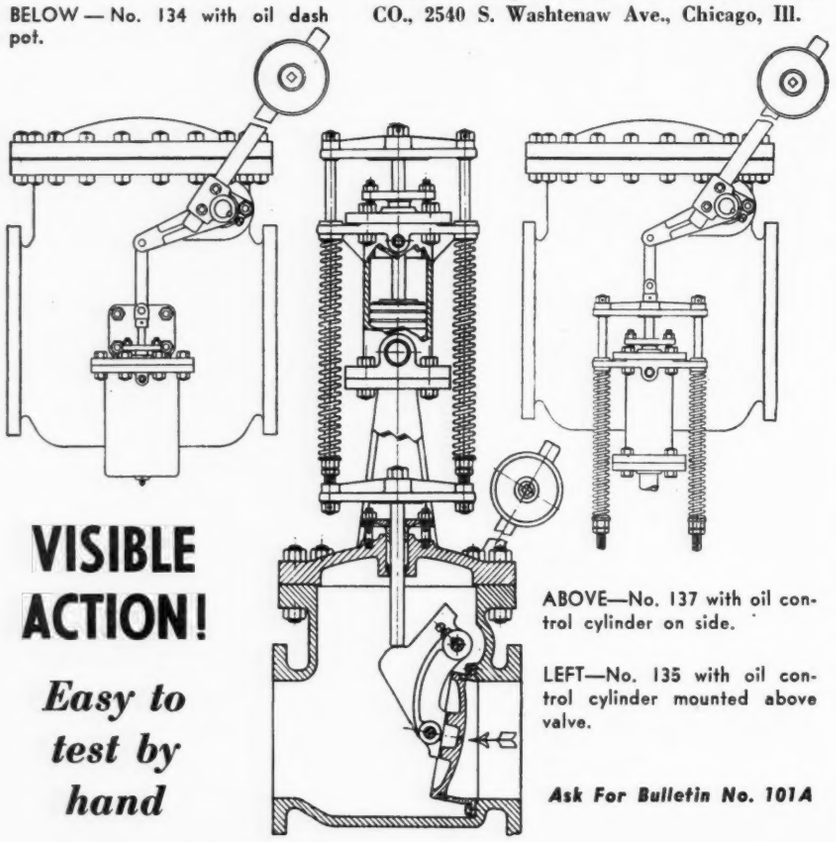
BELOW — No. 134 with oil dash pot.

Balanced Action . . . Davis Swing Check Valves have finely balanced action through use of a counterweighted lever which balances disc assembly. Rugged construction insures smooth operation and long, trouble-free service. For extreme operating conditions, an outside oil dashpot is available. Balanced spring-loaded valves can also be furnished for non-return service.

Straight Flow . . . Disc swings up so that the direction of flow is in a straight line, without obstruction. Pressure drop across Davis Non-Return Valves is negligible.

For Pressures up to 600 lbs. Size from 3" to 24". Steel or semi-steel bodies, with bronze, monel, or stainless steel trim.

Write for complete data. DAVIS REGULATOR CO., 2540 S. Washtenaw Ave., Chicago, Ill.



VISIBLE ACTION!

Easy to test by hand

ABOVE—No. 137 with oil control cylinder on side.

LEFT—No. 135 with oil control cylinder mounted above valve.

Ask For Bulletin No. 101A

DAVIS REGULATOR COMPANY

plied to relatively simple problems for their student's use.

Conduction, convection and radiation are first treated as separate subjects and then their combined effects considered. This book tells the "why" of many puzzling problems of conduction in the unsteady state, the combined effect of heat transfer and changing viscosity of fluids, the phenomena of condensing and boiling and of heat transfer by radiation. Written as a college text, this brief treatment of the complex mathematical problems of heat transmission can be recommended to practicing engineers who have retained their ability to comprehend the exponential formulas of rigid mathematical analysis.

INTRODUCTION TO HEAT TRANSFER (First Edition—1942) *By Aubrey I Brown, Professor of Heating and Ventilating, and Salvatore M Marco, Assistant Professor of Mechanical Engineering, Ohio State University. Published by McGraw-Hill Book Co, 330 West 42nd St., New York, N. Y. 232 pages, 6x9 in., cloth bound. Price $2.50.*

Requiring a background of mathematics no more advanced than simple algebra and elementary calcalus, this text for college seniors and practicing engineers carries on from the point where usual thermodynamics courses leave off. Starting with a comprehensive explanation of the modes of heat transfer, the authors have attempted to present the relationships clearly in the wording, making reference to the mathematical formulas supplementary to the text. Boiling and condensing are treated as well as the usual processes of conduction, convection and radiation. A complete chapter covers application to modern heat exchange equipment. While primarily a college text, this book can be recommended to practicing engineers who have a normal background of physics and chemistry.

Electricity

HOW TO READ ELECTRICAL BLUEPRINTS —1942. *By Gilbert M Heine, Drafting Supervisor of Work on Electrical Controllers, Cutler-Hammer, Inc, and Carl H Dunlap, Head, Electrical Engineering Dept, American School. Published by American Technical Society, Drexel Ave at 58 St, Chicago, Ill. 318 pages, 5½x8 in., 301 illustrations, 9 blueprint drawings, 204 questions and answers, cloth binding. Price $3.00.*

Blueprints or other diagrams of electrical equipment are frequently the only

THE *Gilmer* NATIONAL POWER-RECOVERY PLAN

WAR PRODUCTION BOARD
WASHINGTON, D. C.

IN REPLY REFER TO:
154

April 23, 1942

AIR MAIL - SPECIAL DELIVERY

Mr. John S. Krauss, President
L. H. Gilmer Company
Tacony
Philadelphia, Pennsylvania

Dear Mr. Krauss:

After reviewing the essential elements of the proposed GILMER PLAN and considering the contribution it should make in the conservation of certain critical materials, and also in the important matter of conserving industrial power, we can advise that the Plan is in keeping with the general aims and objectives of the Industrial Salvage Section of the War Production Board, and we are glad to express our appreciation of your efforts in this direction.

The job of conservation and salvage of materials, machinery and supplies, along with the prevention of power losses, is one of the most important facing American industry today.

Very truly yours,

George T. Weymouth

George T. Weymouth, Chief
Industrial Salvage Section
Bureau of Industrial Conservation

COVERS—

- **ELECTRICITY**
- **STEAM**
- **WATER**
- **MECHANICAL POWER**
- **REFRIGERATION**
- **COMPRESSED AIR**
- **BOILER ROOM**
- **PRIME MOVERS**

"It's OK, *Gilmer*!" says WPB

USE WHAT YOU LOSE

INDUSTRY'S vastly accelerated pace is turning power into Strategic Material No. 1. For the success of the war effort, Industry must salvage its tremendous power-wastes, and *use* that power for war production!

To help accomplish this urgent task, Gilmer, in collaboration with leading power engineers, has developed the National Power-Recovery Plan. This Plan is practical and workable, pointing out plainly just *where* and *how* power can be saved with a minimum of time and effort.

Authorities on power estimate that, if the Plan is adopted by America's industrial plants, the resultant power-saving will equal the combined output of two Boulder Dams! Translate that power in terms of *more* warplanes and tanks!

Here's the long-awaited chance to get an official "Go-Ahead" in your battle against power-waste! Show this advertisement to the responsible executive in your plant and get his support. Then put the Power-Recovery Plan to work! It comes completely packaged in a special Booklet. Write to Gilmer for a copy.

L. H. GILMER COMPANY, Tacony, Philadelphia, Pa.

The oldest firm of rubber fabric belt specialists

The Immediate Solution to Your Flexible Connection Problems!

Type RW-81
(annular corrugations)

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(helical corrugations)

REX-WELD* (corrugated) *Flexible METAL Hose

Sizes from ⅛″ I. D. to 4″ I. D. inc. Pressures to 14,500 p.s.i. Temperatures to 1000° F. One-piece, all-metal construction. Continuous lengths to 50 feet.

Rex-Tite Mechanical (Re-attachable) couplings; solder couplings; brazed and welded couplings and flange assemblies for Rex-Weld Flexible Metal Hose.

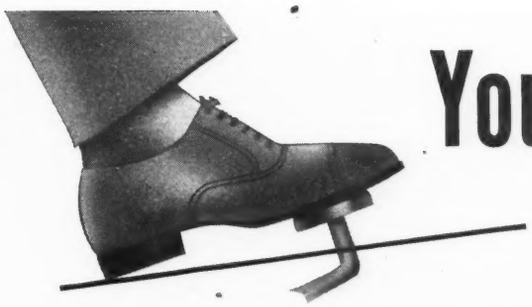
Complete Data on Request

CHICAGO METAL HOSE
CORPORATION
MAYWOOD, ILLINOIS

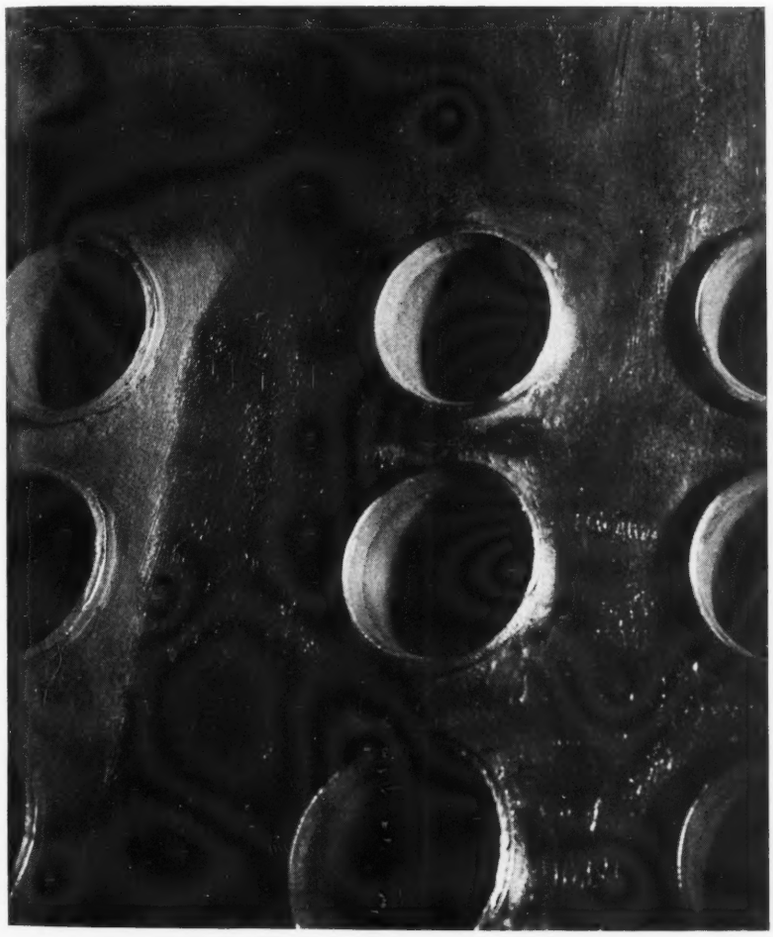
source of information that electrical workers have available. To simplify these drawings the various pieces of apparatus on them are represented by symbols instead of by outline drawings. Therefore a thorough understanding of these symbols is necessary to intelligently read electrical drawings. Accordingly considerable space is devoted to these symbols in this book. Pages of symbols are included in which, opposite each symbol is shown a picture of the object that the symbol represents. Anyone not familiar with a symbol can discover its meaning by a glance at the picture. To avoid confusion the text has been divided into eight parts each one dealing with the blueprints and symbols of a branch of the electrical industry. For example, one section explains how to read blueprints for wiring buildings, another, the diagrams of motors and generators, etc. The explanations are carried out in three steps: First by showing the connection made to outline drawings of the equipment, then on a standard wiring diagram and, third, on a straight-line diagram, so that the student can easily grasp what it is all about. The book is very practical and will be helpful to anyone interested in learning how to read electrical blueprints either by home study or in vocational schools.

DEFINITIONS OF ELECTRICAL TERMS, C42-1942. *Published by American Institute of Electrical Engineers, 33 W 39 St., New York, N. Y. 300 pages, 8x11 in., fabricoid binding. Price $1.00 in U.S.A. and $1.25 outside.*

Sponsored by the American Institute of Electrical Engineers and published as an American Standard, approved by the American Standards Association this volume marks an epoch in the literature of the electrical art in America. For the first time the definitions of the important terms common to all branches of the art as well as those specifically related to each of the various branches have been assembled and presented under one cover. Although started over 30 years ago the present glossary is the result of more than 12-yr work of a section committee of 46 members having 18 subcommittees drawn from available specialists. More than 300 individuals have given material assistance and many others have assisted in specific instances. The 34 organizations represented on the sectional committee include the national engineering, scientific and professional societies, trade associations government departments and miscellaneous groups. The primary aim in formulation of the definitions has been to expres for each

Re-Line  Your Boiler, Too

AN APEXIOR LINING ON WORN BOILER METAL GIVES INDEFINITE SERVICE



A new lining for your brakes to take the punishment and provide safe efficiency is only common sense.

Today, old, but irreplaceable steam boiler equipment — some of it almost ready to be condemned — is being re-lined with APEXIOR — to make the metal last for years to come.

Any boiler that passes the required hydrostatic test when cleaned, can be kept in operating condition indefinitely with APEXIOR protection.

APEXIOR — the Long-Wearing, Renewable Lining for Tubes and Drums

APEXIOR No. 1 is an easily applied protective coating that seals the bare metal against corrosion and direct wear. The new surface takes it all. Scale cannot form a tight bond with APEXIOR — and is quickly removed with a wire brush.

The APEXIORIZED surface lasts 2-3 years or more. And it is easily renewable, with a hand-brush or power coater, to keep the original metal intact.

APEXIOR guarantees good metal condition . . . no other protection offers the same assurance and security

Long-time users of APEXIOR know it as a supplementary protection along with chemical feedwater treatment, helping them maintain long life and most efficient operation for steam boiler equipment.

Present conditions make it mean far more than this . . . a *necessity* in keeping old and new equipment going for the duration.

Write for Bulletin 1290

Recommended by all U. S. and Canadian boiler insurance companies.

APEXIOR REG U.S. PAT. OFF.

THE DAMPNEY COMPANY OF AMERICA

PROTECTIVE COATINGS FOR STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

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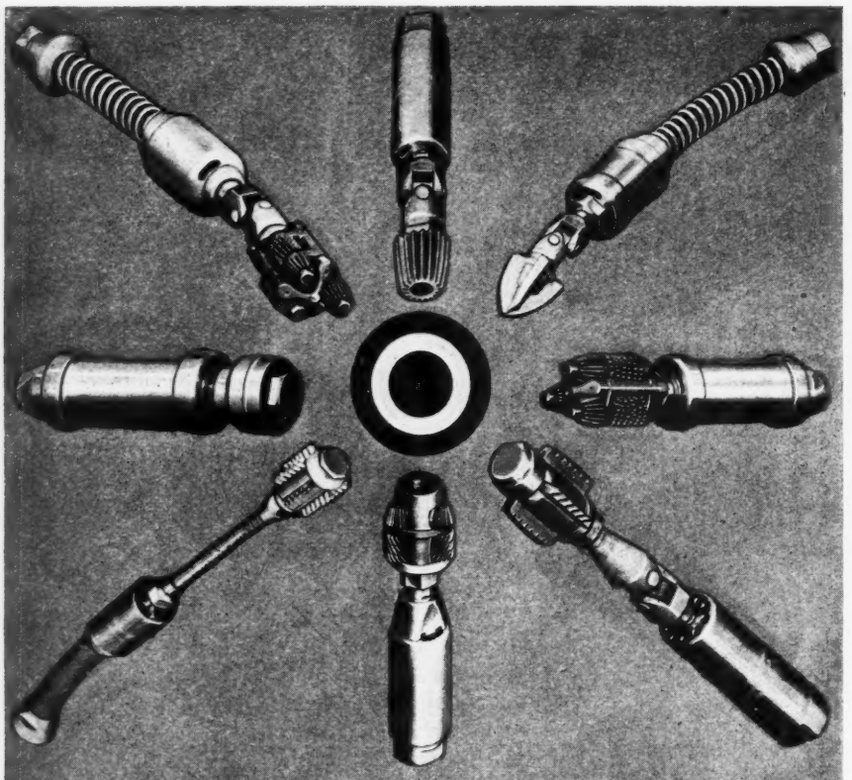

WARTIME PRODUCTION NEEDS CLEAN BOILERS

Every extra pound of steam that the boilers of our war plants can generate—every extra hour that they can operate between cleanings bring nearer the hour of our ultimate victory. To achieve these desirable results *clean* boiler tubes are essential.

In thousands of war plants throughout the country Wilson Tube Cleaners are playing a vitally important part in the national war effort by cleaning boiler tubes *better, faster* and *more economically* and thus assuring *increased* boiler efficiency and greater production of essential war materials.

There is a Wilson Tube Cleaner, cutter head, brush or other accessory for *thoroughly, quickly* and *economically* cleaning *any* straight or curved ferrous or non-ferrous metal tube—of large or small diameter.

Write for the name of our representative nearest to you or for a copy of our NEW forty-page catalog fully describing and illustrating the complete line of Wilson tube cleaning equipment.

THOMAS C. WILSON, Inc.
PIPE AND TUBE CLEANERS EXCLUSIVELY
47-28 37th Street Long Island City, N. Y.

LOCKS TIGHT Defeats Vibration

Cutout-section showing locking ring in place.

Pat'd and Pat's. Pend.

UNSHAKO
Reg. U. S. Pat. Off.

SELF-LOCKING NUT

Self-contained; no separate pins or washers. Built-in locking ring works on the brake band principle. Send for details.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA. BOX 577
— BRANCHES —
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term the meaning which is generally associated with it in electrical engineering in America. This new American Standard has unified and perfected the existing groups of definitions, has rounded out these groups and added many new groups. Its coverage is more than three times that of this field in any other language. It should prove of great value to the general public as well as to scientists and engineers for it is an extension of the function of the recognized dictionaries into specialized fields not hitherto covered.

Brief Reviews

BIBLIOGRAPHY ON CIRCUIT-INTERRUPTING DEVICES, 1928-1940. *Published by American Institute of Electrical Engineers, 33 West 39 St, New York, N. Y. 28 pages, 8½x11 in. Price $.40 per copy to members, $.80 to non-members of the Institute. Discount on 10 or more copies.* List of more than 850 titles includes for 1928-1940 practically all material on the subject published in the American technical and trade press and the principal articles published in other countries. Reference items are divided into subject sections, subdivided by years and listed alphabetically for each year.

CARE AND MAINTENANCE OF CONVEYOR AND ELEVATOR BELTING—*Published by the B F Goodrich Co, Akron, Ohio. 24 pages, paper bound, available on request.* Contains important instructions for the care and maintenance of belting, as well as a wide range of belt data, valuable when considering installations or repairs.

FIRST AID TO INDUSTRY IN CONSERVING RUBBER—*Published by U. S. Rubber Co, Rockefeller Center, New York, 48 pages, copies available on request.* Complete suggestions are given for proper care of rubber products from initial design through inventory and storage to use, maintenance, inspection and care. Includes hose, transmission, conveyor and elevator belts; mechanical packings; electrical tapes; molded and extruded rubber goods, etc.

LESSONS IN PRACTICAL ARC WELDING, by Chaffee. *Published by the Hobart Trade School, Inc, Box EW-82, Troy, Ohio. 188 pages, 5½x8 in., paper cover, over 90 illustrations, price 75 cents. Special prices to schools.* Contains the complete series of arc welding lessons offered at the Hobart Trade School. Material includes preliminary instruc-

WAR PRODUCTION DRIVE HIGHLIGHTS PROPER LUBRICATION

OFFICIAL Plant Book
PRODUCTION DRIVE
WAR PRODUCTION BOARD
U. S. ARMY • THE U. S. NAVY • MARITIME COMMISSION • WAR PRODUCTION BOARD

The plant Production Drive Committee, therefore, should give close attention to such problems as:

1. Taking care of tools.
2. Preventing breakdowns.
3. Cutting down accidents.
4. Good lighting.
5. Maintenance and repair.
6. Adapting old machines to new uses.
7. Cutting wastage.
8. Breaking production bottlenecks.
9. Using every machine to the fullest extent.

Five of the nine suggestions for "Increasing Plant Efficiency" in WPB's PRODUCTION DRIVE include problems in which Standard Lubrication Engineers can give you valuable help. For instance:

2 PREVENTING BREAKDOWNS

• NEW OPERATORS . . . new types of equipment . . . new highs in production . . . any one of these opens the door to increased equipment failures in your plant. These safeguards are more than ever important:

- Examine every motor, reduction gear, or bearing-equipped machine that now carries a heavier load—for adequate lubrication, for leakage, overheating, and oil contamination.
- Revise lubrication schedules to meet the longer hours of operation, higher speeds, and heavier loads.
- Choose lubricants that do the job best, regardless of cost. Today, breakdowns cost lives as well as dollars.
- Impress new operators or maintenance men at the start with the importance of lubrication at proper intervals.

The drive for production is urgent. Your time is limited. Let a Standard Lubrication Engineer work with those in charge of your maintenance. Take advantage of his recent experience in problems just like yours.

Write Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago, Illinois, for the Engineer nearest you.

OIL IS AMMUNITION — USE IT WISELY

Copr. 1942. Standard Oil Company

STANDARD OIL COMPANY (INDIANA)

..LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION

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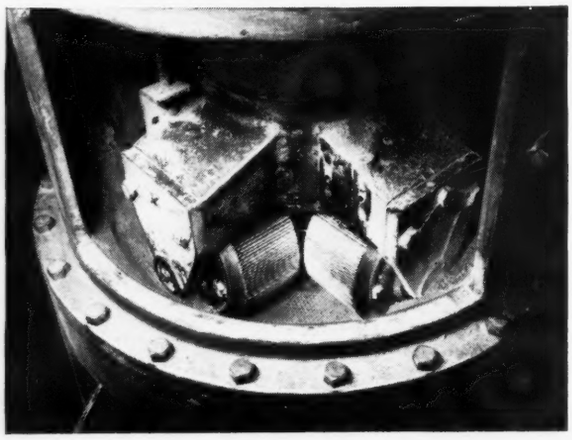
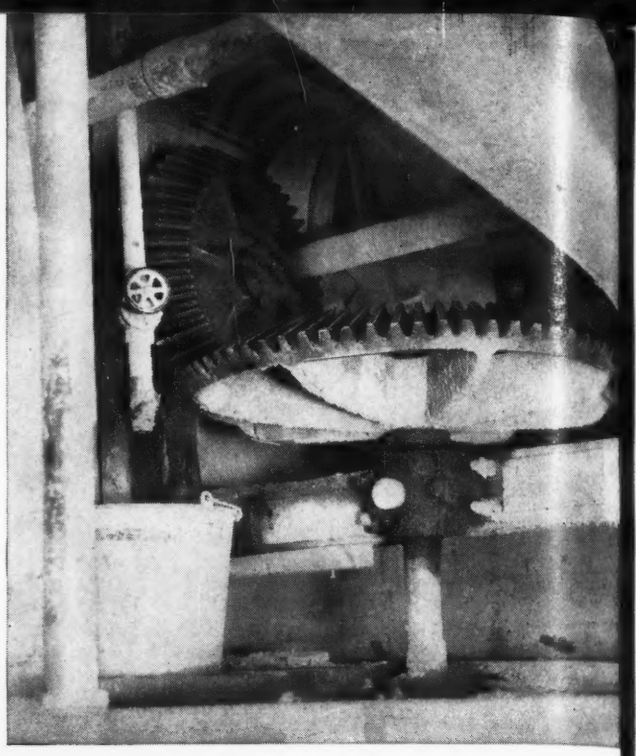
LONG LIFE FROM MILL BEARINGS WITH SUPERLA GREASE

Alvin Enerson, pictured below, is giving you the benefit of a lot of experience, when he says, "Superla Grease has given the results we have been looking for."

His company, the Stockdale Fertilizer Co., Morrison, Illinois, was anxious to realize the long life the manufacturer had built into this excellent equipment. After trying a number of greases, Mr. Enerson found the most satisfactory was Superla Grease, particularly designed for



high grade anti-friction bearing lubrication. Let a Standard Oil Engineer see if he can help you save bearing replacements and maintenance time with the right grade of Superla Grease.



ONE-THIRD AS MUCH GREASE —30% LESS MAINTENANCE— ON OPEN GEARS WITH CALUMET VISCOUS LUBRICANT

Lubrication of open gears in a Minnesota clay preparation plant offered a complicated problem. Conditions varied from exceedingly dry and dusty to very humid. Temperatures ranged from 65° to 100°. Lighter greases were thrown off the gears and contaminated the product, causing excessive waste. Heavier greases did not protect the gears against wear under the dusty conditions. No grease seemed to fit the job, and many were tried.

Then a test was made of Calumet Viscous Lubricant. Here's what B. B. Evans, plant superintendent at the Red Wing Potteries, Inc., reports:

> "We have tested Calumet Viscous Lubricant No. 10X and are now using it on all open gears throughout the plant. We have found this product to be superior to any other used."

Here are some of the savings he made:

- One-third as much grease used—and one-third as many man-hours for lubricating.
- 30% less maintenance—a saving in scarce materials and man power.

If you have a problem of open gear lubrication, ask a Standard Lubrication Engineer to help you make a similar test.

Just write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago, Illinois, for the engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha.

OIL IS AMMUNITION — USE IT WISELY

STANDARD OIL COMPANY (INDIAN

THE COST OF A LOST MINUTE . . .

Each minute lost while machines stand idle may cost hundreds of lives and delay the winning of the war.

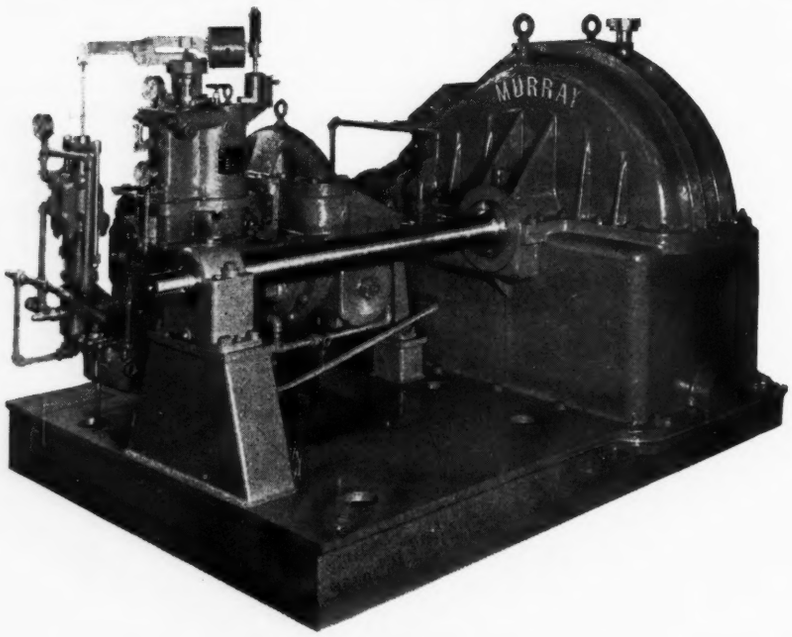
GARLOCK is doing its part for Victory by producing dependable, long-lasting packings and gaskets which help industry avoid frequent shutdowns for repacking and for replacement of gaskets.

GARLOCK

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd.
Montreal, Quebec

MURRAY TURBINES



★ Shows geared Murray turbine for paper mill drive. Employs Type "U" turbine with variable speed paper mill type governor, Herringbone reduction gear with low speed shaft doubly extended for mounting centrally in and arranged for direct connection to paper mill line shaft. This unit is rated at 165 h. p., 5000/400 r. p. m., operates at 190# initial pressure, 80° F superheat, and 25# back pressure. Located in a paper mill in Central Ohio.

POWER will always be the Basis of Production

The important part played by turbines, boilers, and engines in America's war-winning production program is seen throughout our great industrial centers. Organizations that have such Murray equipment are getting the additional advantages of design developed through 70 years of experience.

Priority ratings naturally now determine who will get Murray turbines, boilers, and engines. There is, however, a tomorrow ahead when we will all be working again under peace-time conditions.

It is for such time that we should all be planning in addition to our big production job now. Your cooperation in anticipating future needs will help greatly. Consult with our engineers even though you are not in line for quick delivery of Murray equipment.

BOILERS TURBINES ENGINES

MURRAY IRON WORKS COMPANY

INCORPORATED 1870

BURLINGTON IOWA

tions; starting and manipulating the arc; welding with bare electrodes; welding light gauge sheets with coated electrodes in the flat—horizontal—vertical and overhead position; pipe and cast iron welding; and special practice. This text, which was taken from Part 2 of the complete Hobart text book, *Practical Arc Welding*, explains the fundamentals of arc welding in a simple and easily understood manner. It also contains a suggested classroom procedure as well as quiz questions at the end of each exercise. Suitable for beginners and for shop training programs.

New Equipment

(*Continued from page* 136)

together with an over-all backing of porcelain enamel, will keep the glass from shattering even if it is broken by a severe blow. Reflector is joined to a metal socket housing which is thoroughly sealed with a heat-resistant gasket, acting as a preventative against the entrance of water and making the floodlight corrosion proof. Utilizes 300- or 500-watt lamps. *General Electric Company, Schenectady, N. Y.*

Stack Coating

CORROSION AND HEAT-RESISTANT stack coating will withstand temperatures up to 900 F without sagging or deteriorating in any way, according to maker. Coating is of a constantly flexible nature which will not crack, chip or peel even when subjected to instant temperature change from 900° F to freezing and completely retains its adherence and protective qualities. Provides protection against corrosive atmospheres and materials including acids, alkalies, sulphur fumes, byproduct gases, salt air or water and ordinary moisture. *Carbozite Corporation, Pittsburgh, Pa.*

Hand-Wiping Safety Solvent

HAND-WIPING SAFETY SOLVENT is to be marketed as a safety replacement for naphtha, gasoline, kerosene. Although designed for removing cosmoline from rifles, solvent is also applicable to wide industrial use as a naphtha substitute for grease-cleaning and hand-wiping operations, solvent is to be used as a concentrate and to be diluted with water. In spite of its high solvency against mineral oil or dirt, solvent does not de-oil the skin, has no toxic vapors.

WHAT PART HAS *Pipe* IN THE WAR PROGRAM?

YOU'LL probably be surprised. For example: A bed for one of Uncle Sam's soldiers takes twelve feet of pipe. A water line for just one cantonment is many miles long. A single demolition bomb starts from more than a thousand pounds of steel tube. The boilers of our newest battleships contain tons and tons of seamless boiler tubes. An army bomber may require a thousand pounds or more of mechanical tubing. Uncounted numbers of shells, tank parts, cannon mounts, machine gun rests, etc., all take an enormous quantity of pipe and tubes.

We wish you could see the ceaseless activity going on within NATIONAL Tube Company mills, the speeding up of production facilities, the improvements through tireless research. Then you would share our confidence that whatever the call for tubular products for war requirements, NATIONAL Tube will be ready to do its full part.

We are glad that in this emergency we have been able to render our country quick, vital and quantity aid. We're all in the same boat, pulling to the same end—mill, factory, distributor, and consumer.

It's a journey none of us wanted to take, but having embarked on it, we Americans shall see it through.

NATIONAL TUBE COMPANY

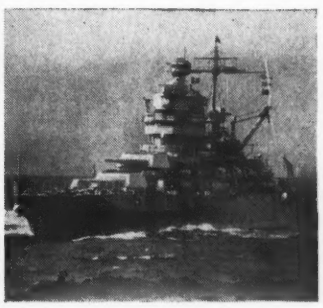
PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL

TRENCH MORTARS stand firmly on supports of SHELBY Tubes.

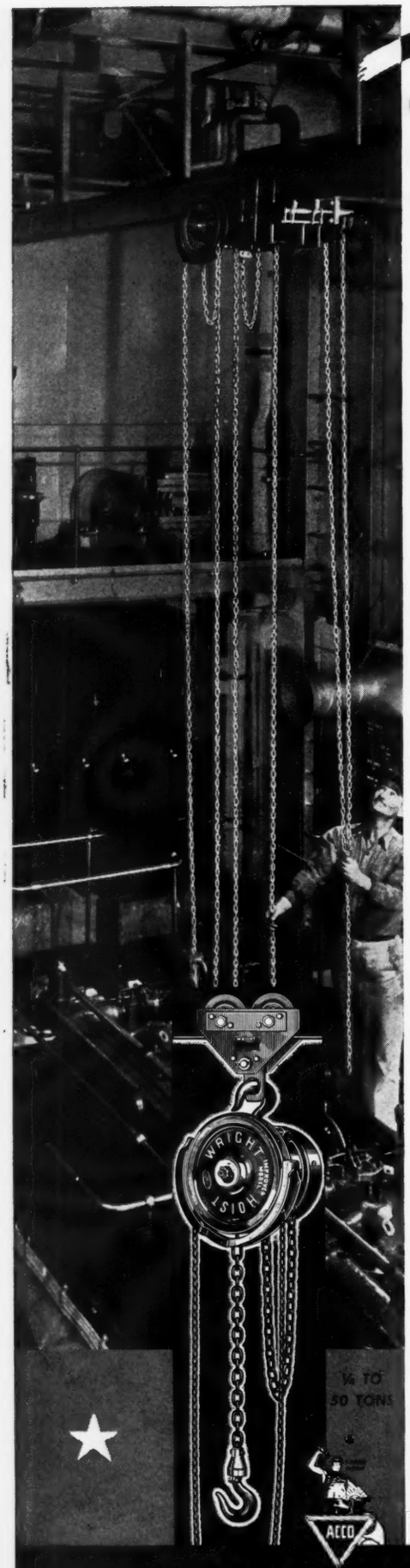
TANKS of all kinds call for vast quantities of Seamless Tubing.



BATTLESHIPS are a maze of pipe and tubes, from stem to stern.

MODERN BOMBERS use SHELBY Aircraft Tubing in many parts.

AMERICA'S STANDARD WROUGHT PIPE



Don't OVERLOAD YOUR HOIST

• Although **WRIGHT HOIST** are built with load-carrying factors much in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Abuse to machinery, today, is akin to sabotage.

WATCH THE BOTTOM HOOK

• Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, gives visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

WATCH THE LOAD CHAIN

• **WRIGHT HOIST** load chains are electrically welded from special analysis steel, exceptionally high in tensile strength and elastic limit. Chains that are excessively overloaded will stretch out of pitch, thus preventing proper fit with precision load wheel pockets. This results in destructive wear to both chain and load wheel. Keep your chains well-lubricated for long life.

Victory demands all out efficiency in production. Victory demands speed. Victory demands steel. Abuse of machinery wastes all three. Take proper care of your **WRIGHT HOIST** so that it lasts. You can find the name of your nearest Wright distributor in the telephone book.

WRIGHT MANUFACTURING DIVISION
York, Pa., Chicago,
San Francisco, New York

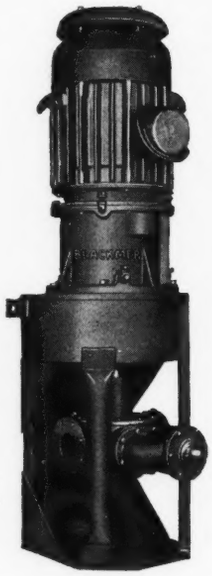
In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

no flash or fire point, and leaves an invisible rust preventative film so thin it cannot be detected. *The Curran Corporation, Malden, Mass.*

Vertically Mounted Rotary Pump

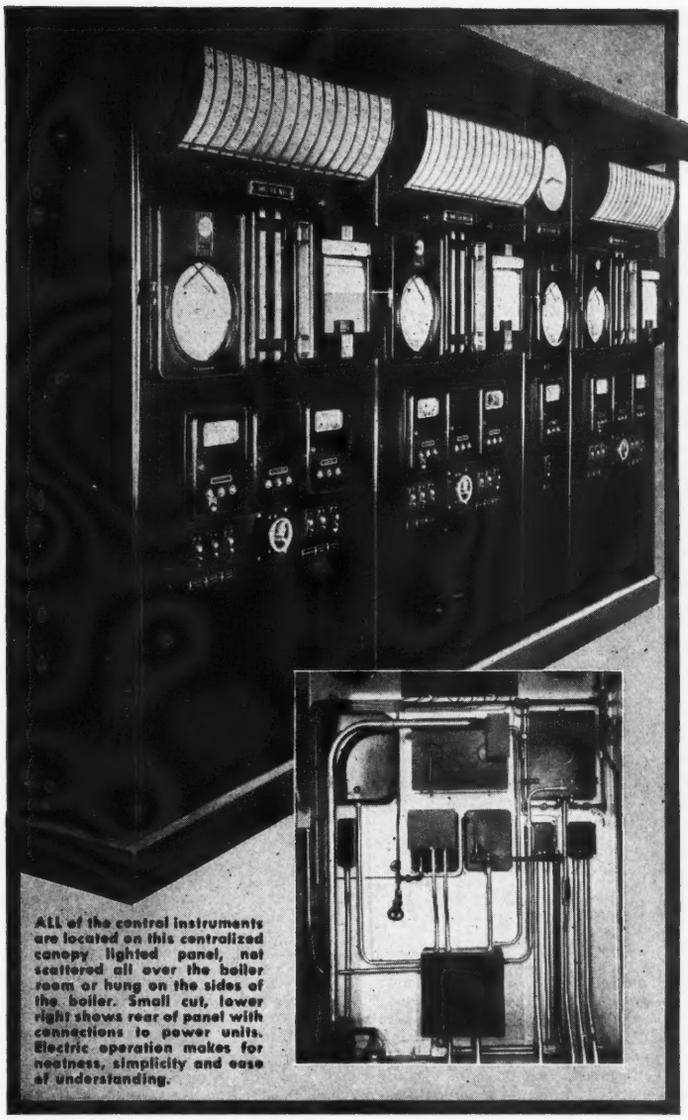
VERTICALLY MOUNTED Blackmer pump has typical "Bucket Design" principle, and with the exception of minor changes in design necessary to allow for vertical mounting, it is standard Blackmer rotary pump. Unit now in production has capacity of 150 gpm at 100 psi and is powered by 15-hp gear-head motor. Same pump and mounting is also furnished in capacities from



5 to 700 gpm and in pressures up to 300 psi, for marine and a wide range of industrial applications. An important feature of the pump is that when the buckets are completely worn out, unit may be restored to its original efficiency by simply removing head, pulling out old buckets, replacing them with new buckets and replacing the head. In small capacities pump has wide application as original equipment on liquid-processing and liquid-handling machinery. *Blackmer Pump Co, Grand Rapids, Mich.*

Forced Induction Pumps

"PILE DRIVERS" pumps are designed to dispense heavy, viscous materials such as sealing compounds, sound deadeners, insulating materials, putty, heavy lubricants and other substances too heavy and solid to prime in any other type of pump. Unit is available in single or two stage models, both employing standard Lincoln air motor. Two sizes can be furnished, the "100" for pumping mate-



ALL of the control instruments are located on this centralized canopy lighted panel, not scattered all over the boiler room or hung on the sides of the boiler. Small cut, lower right shows rear of panel with connections to power units. Electric operation makes for neatness, simplicity and ease of understanding.

Electric
ALL THE WAY!

HAYS
CENTRALIZED AUTOMATIC COMBUSTION CONTROL

Stokers, pulverizers, fans and oil burners are more and more becoming electrically driven. It is entirely logical therefore that an automatic combustion control system be operated electrically. Hays *centralized* control is operated entirely by electricity, employing enclosed mercury switches for the sensitive contacts, thus assuring freedom from trouble due to moisture, dust, dirt and chattering. Electric operation also simplifies installation and maintenance. Adjustments are made direct and are not dependent upon air pressures, oil pressures, and the numerous valve mechanisms made necessary by non-electric designs. When considering automatic combustion control buy for tomorrow—buy electric—buy HAYS.

HAYS

Automatic
COMBUSTION CONTROL
THE MODERN SYSTEM—*it's Electric!*

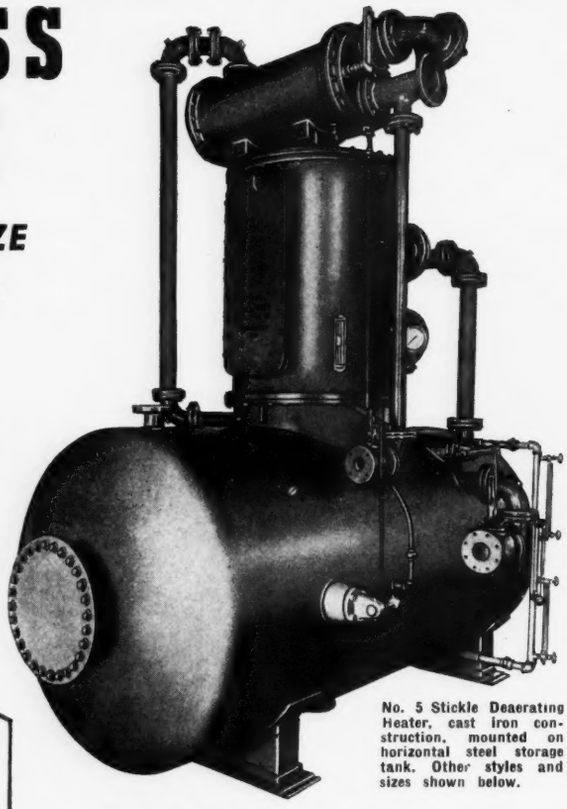
THE HAYS CORPORATION • • • MICHIGAN CITY, INDIANA

STICKLE OPEN COIL FEED WATER HEATER

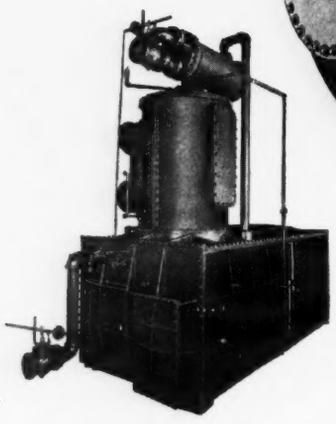
HEATS MORE WATER IN LESS SPACE

A TYPE AND SIZE TO MEET YOUR NEEDS

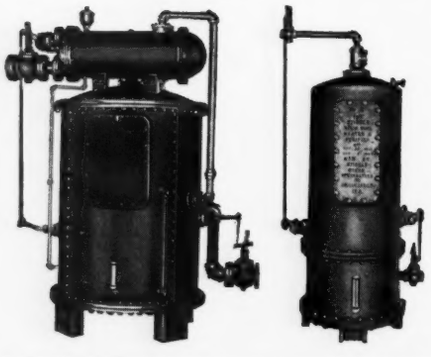
Cast Iron or Steel Construction. Deaerating and Non-deaerating Types. Small to large capacities. Standard storage or built to meet large storage requirements.



No. 5 Stickle Deaerating Heater, cast iron construction, mounted on horizontal steel storage tank. Other styles and sizes shown below.



The Stickle Open Coil Heater design has greater tray surface, brings feed water into direct contact with steam, and permits instantaneous transmission of heat from steam to water. Conserves all steam condensed in heating make-up water for boiler supply. All internal parts easily removed through door. Trays quickly cleaned of incrustation whenever necessary. Design adaptable to requirements of varying plant conditions. Stickle Heaters in wide use in federal, state and municipal institutions and in all kinds of manufacturing plants in private industry. New Bulletin No. 117, heavily illustrated with various types and sizes of heaters, supplies complete information.



OTHER STICKLE EQUIPMENT

Steam Traps for high pressure service—Stickle Series AE—for capacity range of 5000 lbs. to 21,000 lbs. per hour, affording four times capacity of old standard traps in ratio to size. See Bulletin No. 315 for complete description and data.

Steam Traps for high and medium pressure service—Stickle Series 100—for capacities of 500 lbs. to 3000 lbs. per hour. Made for straight-in-line installation. See Bulletin No. 115 for complete information.

Steam Traps for low pressure and vacuum service—Stickle Series T—in complete range of sizes from small to large traps. Ask for Bulletin No. 415.

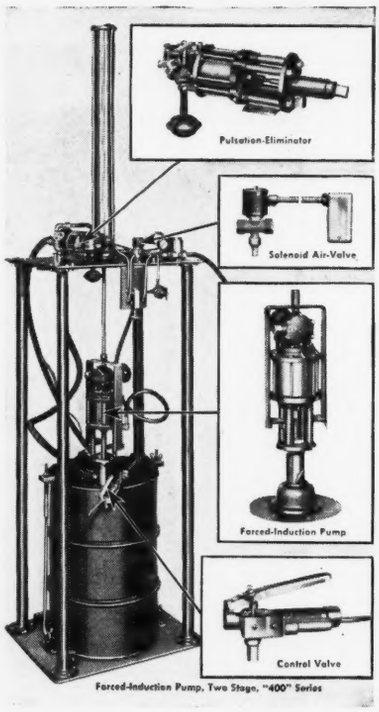
Regulating and Reducing Valves for accurate and exacting control of steam, air and liquids. All pipe sizes. State requirements and ask for Bulletin Nos. 235 and 435.

STICKLE

STEAM SPECIALTIES COMPANY

2265 Valley Avenue, Indianapolis, Indiana

SPECIALIZING FOR 35 YEARS IN REDUCING THE COST OF STEAM

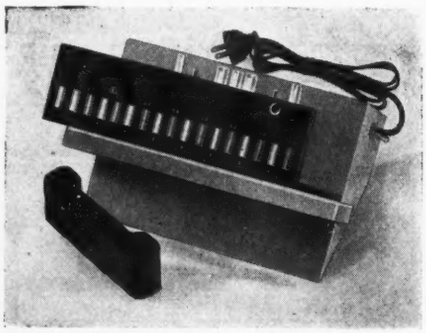


Forced-Induction Pump, Two Stage, "400" Series

rials from containers up to 10-gal capacity, and the "400" for pumping material from 55-gal drums. Single-stage unit is for use where pulsation in material flow is permissible. The 2-stage unit has a pulsation eliminator which does away with the pulsation and delivers the extruded material at an even rate of flow and in uniform size and shape as desired. Delivery of materials in both models is controlled by a hand-operated shutoff valve at the outlet and is always under the operator's control. *Lincoln Engineering Co, 5701 Natural Bridge Ave, St. Louis, Mo.*

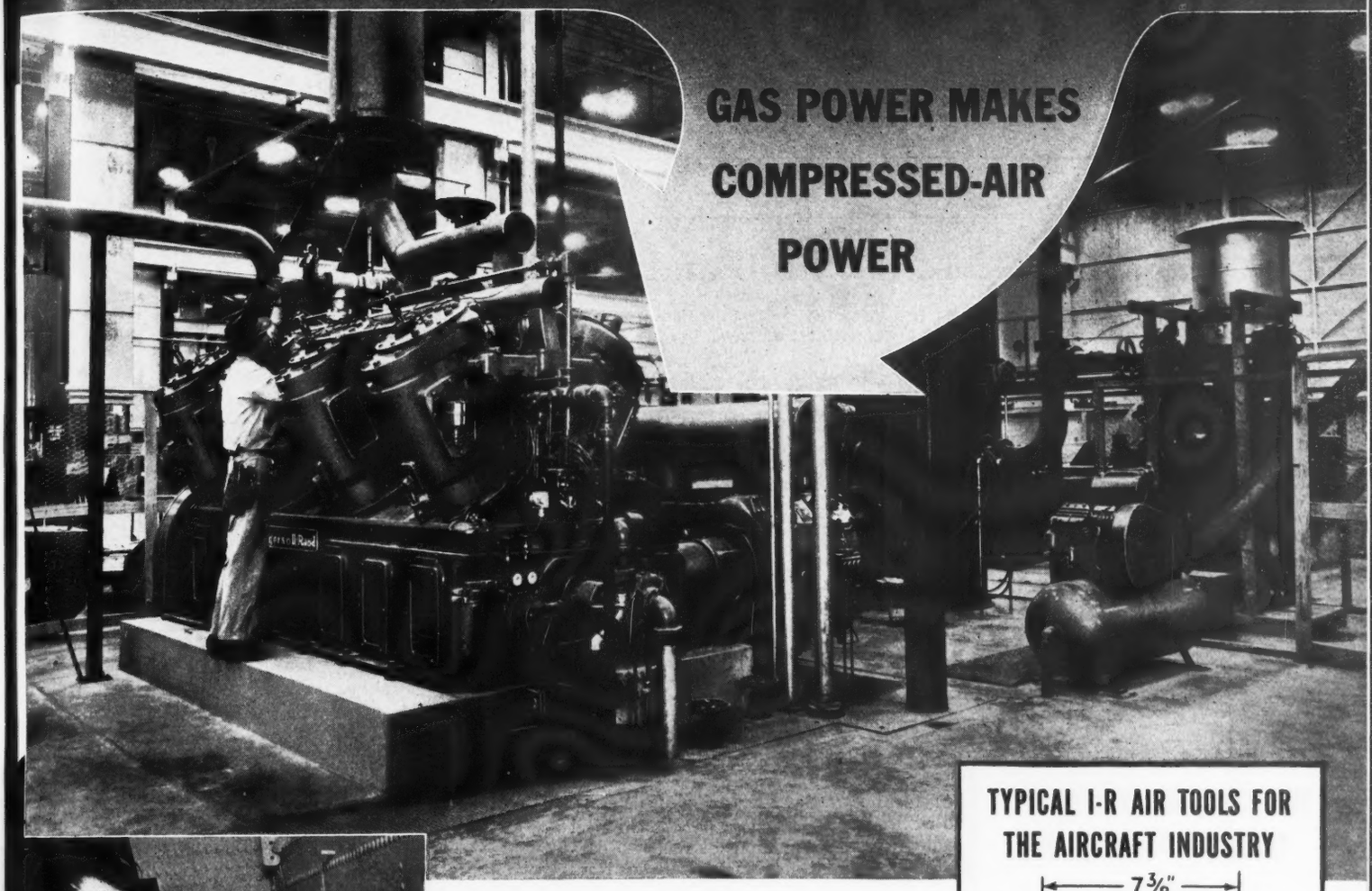
Midget Testing Lamp

ALTHOUGH MIDGET DALITE LAMP was designed for use with Taylor slide comparators when determinations had to be made at night or in dark places, it has been found to be ideal for all routine testing even in daylight. Comparator base sits on the shelf at an angle of 45 deg so that in making read-



ings, one can look directly into the slots in the slide and base. This eliminates handling outfit, with possible

AT THE DOUGLAS AIRCRAFT BLACKOUT PLANT



GAS POWER MAKES COMPRESSED-AIR POWER

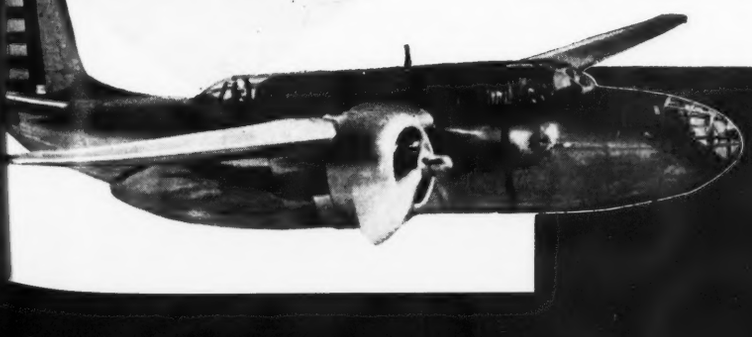
COMPRESSED-AIR POWER *Builds* AIR POWER

● At the Douglas Aircraft Company's new blackout plant in California, where natural gas serves many purposes, Ingersoll-Rand 300-hp heavy-duty XVG gas-engine-driven Compressors provide the air power for many hundreds of Ingersoll-Rand Air Tools. These riveters and drills are speeding up the work in the Douglas all-out Victory program.

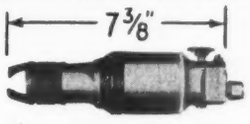
Air tools play an important part in airplane production because they are light in weight and easy to handle... packed with power... flexible... durable... of simple, strong design. And air tools are safe!

Ingersoll-Rand manufactures a complete line of Air Tools; also a full line of Compressors for electric, steam, oil, or gas engine drive. Let us send you complete information.

14-160

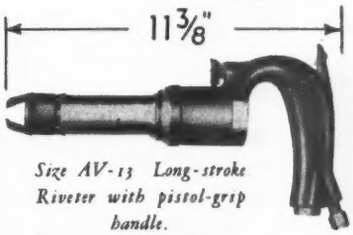


TYPICAL I-R AIR TOOLS FOR THE AIRCRAFT INDUSTRY



Size AV-11 Lightweight Riveter with push-button throttle.

Size AV-12 Lightweight Riveting Hammer with offset handle.

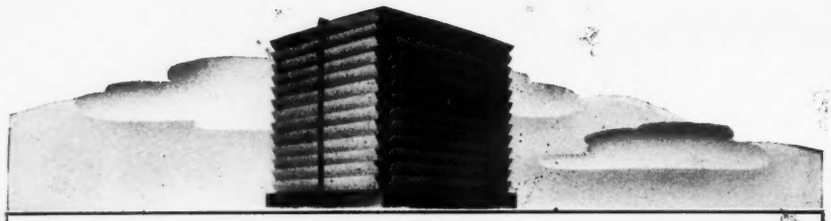


Size AV-13 Long-stroke Riveter with pistol-grip handle.

Size OL—Drill with pistol-grip handle.

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY



How to Save Strategic Chemicals and Still Control Slime and Algae

By JOHN D. FLEMING, Sales Development Department
MONSANTO CHEMICAL COMPANY

SANTOBRITE (sodium pentachlorophenate), the effective and highly efficient algaecide and bactericide developed by Monsanto for the control of slime and algae in industrial cooling-water systems, is still available for that purpose.

Supplies of both phenol and chlorine, however, the raw materials from which Santobrite is manufactured, are critically tight, and it is essential that the most efficient possible use be made of every ounce of Santobrite.

Experience has indicated that under practical conditions, about 20 parts per million of Santobrite will give good control of the slime and algae formations which otherwise build up on heat transfer surfaces to the great detriment of operating efficiency. The exact dosage for your particular cooling-water system, however, depends on the types of organisms found in your system, the extent of contamination and environmental factors.

To determine the smallest dosage you can use and still keep your heat transfer surfaces film-free, the following steps are recommended:

1. Establish in the circulating water system a concentration of about 40 p.p.m. of Santobrite. (Standard types of wet or dry feed mechanisms can be used but Santobrite can be just as easily and efficiently introduced by hanging one-ounce briquettes in a wire basket in a circulating water passage where they will dissolve gradually.)

2. Maintain the concentration of 40 p.p.m. for about 10 to 15 days, which is usually long enough to completely kill and remove any existing slime and algae deposits.

3. Gradually *reduce* the chemical concentration for 15 to 20 days until the algae growth just reappears. Then *increase* the concentration by about 5 p. p. m. and maintain at this figure.

4. Maintain the minimum effective concentration thus determined by daily or semi-daily additions.

The daily make-up dosage is computed on the basis of the amount of fresh water added to the system. The initial charge, of course, is computed from the static capacity of the system.

Since the application of Santobrite requires no special equipment and only a nominal amount of labor and supervision, the principal cost of the treatment is the cost of the chemical itself. For a typical cooling tower system, serving a 55-ton Freon air-conditioning installation, the total cost for an average season from April to November was less than $5. On several large industrial systems, the cost has averaged about 40 cents per million gallons of water, circulated.

Santobrite can be efficiently used in all industrial cooling-water systems where the bulk of the cooling water is recirculated and reused, and where it is not used for drinking or bathing. Santobrite is not economically practical, however, for systems where the cooling water is not recirculated or where only a small part is recovered.

For full information on Santobrite, how, when, where and how much to use for best results, write today for Monsanto Technical Bulletin 0-15. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, St. Louis, Missouri.

MONSANTO CHEMICALS

"E" for Excellence . . . denoting the highest service accomplishment of the United States Navy...flies over Monsanto "in recognition of production of ordnance materiel vital to our national defense." In addition to the Ordnance flag and "E" pennant, above, Monsanto has now been awarded the All-Navy "E" burgee "for excellence in war production."

SANTOBRITE
for Slime and Algae Control

SERVING INDUSTRY . . . WHICH SERVES MANKIND

chance of breakage, as only the sample tubes need be handled. The lamp gives uniform daylight conditions at all times. Operates on any 110-volt circuit. Can be used with any Taylor pH, chlorine or phosphate comparator. *W A Taylor & Company, 7300 York Road, Baltimore, Md.*

Corrosion Inhibitor

INHIBITOR IS THE FERRIC SALT of quachrom glucosate and introduces a non-oxidizing chromium inhibitor for the first time. Identified as ferri chrom glucosate, it controls corrosion in some applications in concentrations as low as two parts per million and may be employed to reduce equilibria and at low pH values for corrosion control. Can be used as a colloidal gel which may be used for film formation in process operations by dipping or spraying or may be incorporated in paints or lubricants for corrosion control. Contains very little chromium and is non-irritating to handle. Its use for corrosion application may reduce chromium consumption for this purpose as much as two decimals at the same time providing more effective control. *D W Haering & Co, Inc, 205 W Wacker Drive, Chicago, Ill.*

New Power Construction

Construction to Come

California—Bids June 10, by Bureau Reclamation, Customhouse, Denver, Colo., constructing oil-storage tanks for Keswick power plant, Kennett Div. Central Valley Project, Spec No. 1636-D.

Calif., Wilmington—Los Angeles City Dept Water & Power, 207 S Bway, Los Angeles, rejected bids Apr 16, constructing superstructure Harbor Steam Plant, Spec 4162, $300,000. H C Gardette, 207 S Bway, Los Angeles, engr.

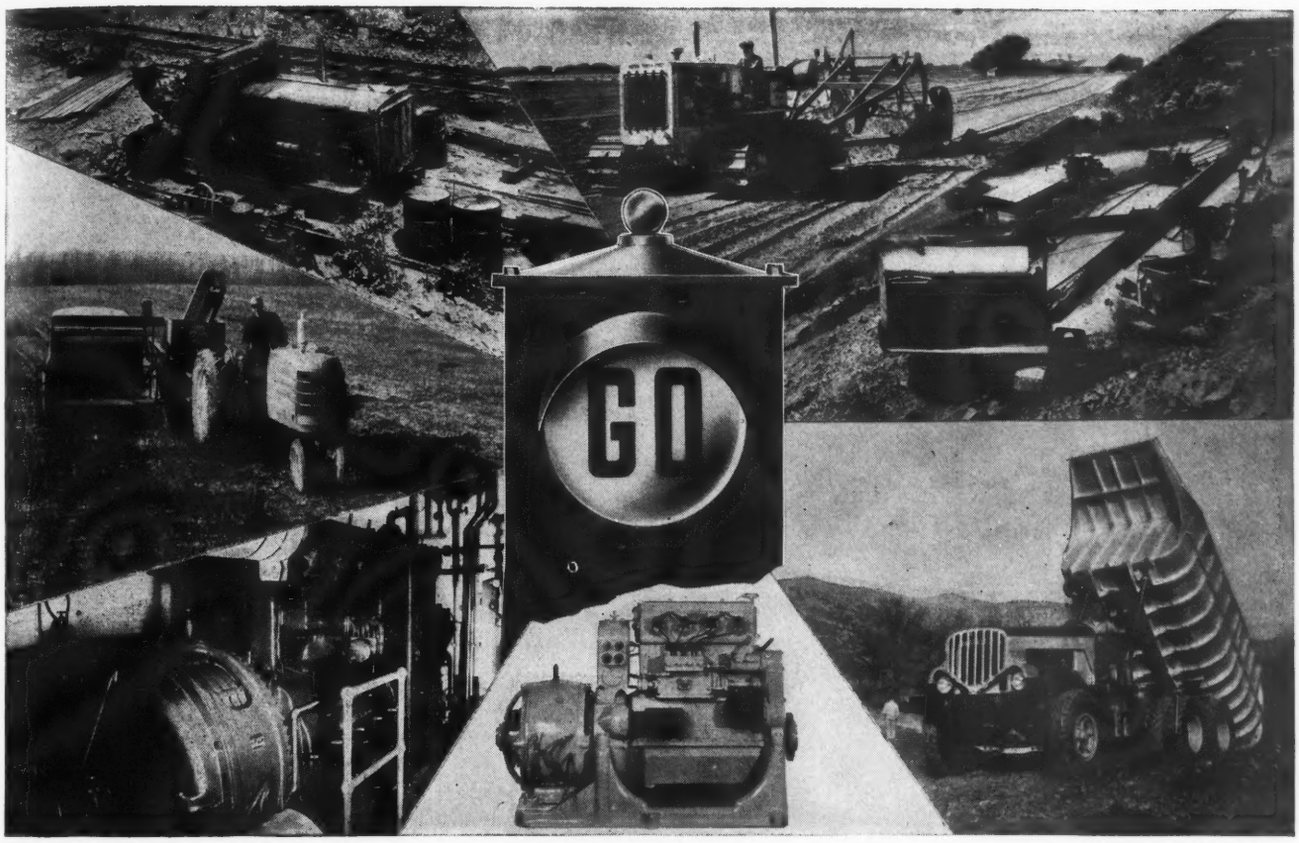
Colorado—U S Eng, Denver, bids soon constructing reservoir, service pumps, pump houses, gate houses.

Connecticut — Industrial company receiving bids (from selected bidders), brick, steel factory. $4,500,000. J R Worcester & Co, 79 Milk St, Boston, Mass., engrs.

Connecticut (br. Hartford)—Bids after June 15, by industrial company, constructing brick, steel plant. $1,000,000. Mylchreest & Reynolds, 238 Palm St, Hartford, engrs.

Florida—Yards & Docks, Navy Dept, Wash., D. C., plans constructing bldgs. $2,000,000.

Illinois—Industrial company plans constructing plant addn. Over $1,000,000. Central States Engineers, Inc, 1515 Sherman Ave, Evanston, engrs.



Production Gets the Green Light— When Your Diesels Go Cities Service!

Steady operation for super-production — that's the order of the day for every Diesel engine owner! It means fewer stoppages, fewer overhauls. And parts must last longer—even though your engines are driving harder than ever.

Today, production is a race against time. An hour lost is victory delayed. A day's halt may spell disaster.

Your big problem then is how to go *all-out* for victory without *time-out* for repairs . . . how to achieve *steady, continuous performance without breakdown.*

You'll find a Cities Service lubrication engineer a great help in beating this problem. He understands what you're up against, and he speaks your language. And, most important, he's got the necessary "know-how" to tackle your particular job. So why not get together with him on a lubrication plan that will keep your Diesels in continuous service — with no time lost for costly repairs?

There is no charge for this friendly consultation. Simply fill in the coupon below and mail it today.

An informative, up-to-the-minute booklet, "Diesel Engine Lubrication," is yours for the asking. Just check the space indicated!

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
CHICAGO · CLEVELAND · ST. PAUL
KANSAS CITY · BOSTON · TORONTO
or to
ARKANSAS FUEL OIL COMPANY
SHREVEPORT · ATLANTA · BIRMINGHAM

Please send me information concerning your Engineers' Lubrication Service. ☐

Please send me your booklet, "Diesel Engine Lubrication." ☐

Name_____

Firm Name_____

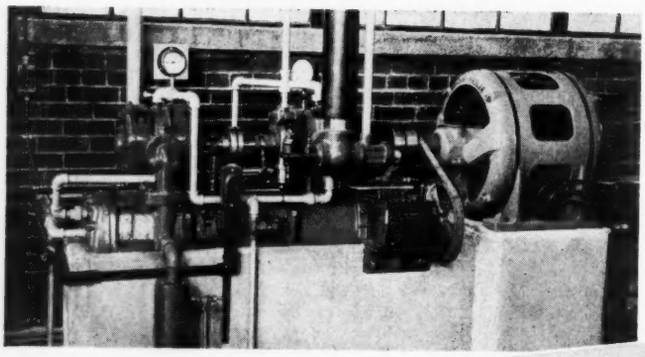
Address_____

City_____ State_____

P. R.

A LUBRICANT FOR EVERY INDUSTRIAL NEED

Four Years' Operation . . . No Maintenance Expense



February 23, 1942.

The Fuller Company,
Catasauqua,
Penn., U.S.A.

Attn: Mr. E. P. Meixwell

Gentlemen:

In January 1938 we purchased a two-stage Fuller Rotary Compressor Size C-16-16H, and since installation it has run 23 hours per day almost continuously and has given no trouble.

As we are dependent upon an air supply for a number of operations and would be greatly inconvenienced in case of machine failure, we are considering the possible need of machine spare parts which could be used in case of a breakdown.

Are there such parts which experience has shown may need replacement due to wear or breakage, and which should be kept in stock, especially in view of the present and future industrial conditions which might make the replacement more difficult to obtain?

Your recommendations in this connection would be greatly appreciated.

Yours very truly,

YOUR COMPRESSORS spot WHERE YOU NEED THE AIR

Here's a letter that tells a story better than any words we could use. Nor is it an exceptional case . . . hundreds of users of Fullers are reaping the same benefits. It further strengthens the claims we have been making, that you too can profit by installing Fuller Rotary Compressors and Vacuum Pumps.

There's every logical reason for long, continuous service with these units. Simple, sturdy construction; a minimum of moving parts—rotor, bearings, blades.

In these times when shut-downs are costly . . . lost time can never be recovered . . . it's up to you to see that the very best equipment is installed in your plant.

FULLER COMPANY

CATASAUQUA, PENNSYLVANIA

Chicago: 1144 Marquette Bldg. San Francisco: 320-321 Chancery Bldg.

C-70

FULLER-KINYON, FLUXO, AND AIRVEYOR CONVEYING SYSTEMS . . . ROTARY FEEDERS AND DISCHARGE GATES
ROTARY AIR COMPRESSORS AND VACUUM PUMPS . . . AIR QUENCHING COOLERS . . . BIN SIGNALS

Illinois—U S Eng, Courthouse & Customhouse, St. Louis, Mo., plans constructing warehouse. Over $3,000,000.

Illinois—U S Eng, 932 Post Office Bldg, Chicago, plans constructing mfg plant. Over $3,000,000.

Illinois—United States Steel Corp, 208 S LaSalle St, Chicago, Ill., plans constructing plant. Defense Plant Corp will finance.

Ill., Jacksonville—City plans constructing light and power plant addn. $200,000.

Ill., Jacksonville—National Enameling & Stamping Co, Granite City, bids soon constructing plant addn. $1,250,000 incl equip.

Indiana—Defense Plant Corp, 811 Vermont Ave N W, Wash., D. C., completed plans constructing plant. $6,150,000. Albert Kahn, Inc, 345 New Center Bldg, Detroit, Mich., archt.

Indiana — Industrial company plans nearing completion by Harley & Ellington, Opera House Bldg, Terre Haute, constructing two warehouses for War Dept. $5,000,000-$6,000,000.

Indiana—Chrysler Corp, 341 Massachusetts Ave, Detroit, Mich., plans constructing plant addns, for War Dept.

Indiana — Industrial company plans constructing plant. $50,000,000. Federally financed.

Indiana — Rubber Synthetic Co, Inc, Gary, composed of Standard Oil Co of Indiana, 910 S Michigan Ave, Chicago Ill., Sinclair Refining Co, 630 5 Ave, New York, N. Y., Cities Service Oil Co, 70 Pine St, New York, N. Y., Dow Chemical Co, Midland, Mich., U S Rubber Co, 1230 6 Ave, New York, N. Y., and Firestone Tire & Rubber Co, 1292 Firestone Parkway, Akron, O., plans constructing plant. $50,000,000. Defense Plant Corp will finance.

Iowa—War Dept, 20 St and Constitution Ave N W, Wash., D. C., plans constructing bldg. Over $9,000,000.

Iowa—War Dept, 20 St and Constitution Ave N W, Wash., D. C., plans constructing plant. $90,000,000.

Me., Kittery—Federal Works Agency, 2 Lafayette St, New York, N. Y., plans constructing pump plant, 2100 ft pipeline, appurtenances. Whitman & Howard, Inc, Broad St, Boston, Mass., engrs.

Maryland—Bethlehem Steel Co, 1101 Key Highway, Baltimore, cancelled bids to have been opened May 6, constructing imprvs, shop, powerhouse, etc.

Md., Sparrows Point (br. Baltimore)—Comrs Baltimore Co, Towson, plans constructing sewerage sys, incl force mains, three pump stations, treatment plant. $900,000. S A Green, Court House, ch engr Baltimore County Metropolitan Dist Robert T Regester, Baltimore Life Bldg, Baltimore, consult engr.

Massachusetts — Remington Arms Co, Barnum Ave, Bridgeport, Conn., plans altering renovating plant. $7,500,000. Defense Plant Corp will finance.

Mo., Neosho—Crowder Cleaners, Inc, Neosho, plans by O Willis, 206 Webster Bldg, Kansas City, Mo., constructing one-story, 48x112-ft concrete tile boiler and storage plant, 48x80 ft frame plant, 30x50 ft frame office, $45,000.

N. J., High Bridge—Taylor-Wharton Iron & Steel Co, c/o L E Crampton, High Bridge, plans constructing powerhouse, storage shed $75,000.

North Carolina — Industrial company plans constructing plant, for Navy Dpt Sanderson & Porter, 1903 Liberty Life Bldg, Charlotte, engrs.

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In these days of shortages it behooves all of us to conserve that which we have. Rarely do either your automobile tires or your Sloan Flush Valves need attention, but since everything entering into their manufacture is on the critical list, they deserve it now.

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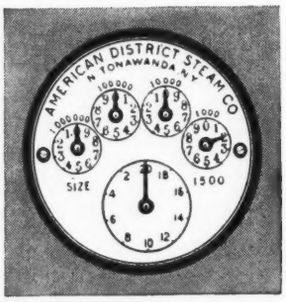

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Combines High Accuracy With Low Cost

Ohio—Bid June 3, by Industrial company constructing factory, also 40x40-ft boiler house, Plant 5, $500,000. Wilbur Patson & Associates, 4614 Prospect Ave., Cleveland, engrs.

Oklahoma—Continental Oil Co, Ponca City, bids soon constructing plant, $4,000,000; plant, $3,500,000. Defense Plant Corp will finance.

Okla., Ardmore—U S Eng, 416 Wright Bldg, Tulsa, plans constructing buildings. $6,000,000.

Oregon—U S Eng, Pittock Blk, Portland, bids soon constructing bldgs, shops, storage, etc. $1,000,000.

Pennsylvania — Industrial Company, plans constructing addnl plant facilities. Over $5,000,000. Defense Plant Corp will finance. Gibbs & Hill, 450 7 Ave, New York, N. Y., engrs.

Pennsylvania—Standard Stoker Co, Inc, 1701 Gaskill Ave, Erie, plans constructing factory addn. $1,000,000. Federally financed.

Pennsylvania—U S Steel Corp, 208 S La Salle St, Chicago, Ill., plans constructing plant. Defense Plant Corp will finance.

South Carolina—U S Eng, Camp Croft, revised plans, new bids soon, constructing cold storage plant alterations and addns. CE 2-34-42-2808. Bids not opened May 20.

Tennessee—Yards & Docks, Navy Dept, 1 St and Constitution Ave N W, Wash., D. C., plans constructing imprvs, blds. $10,000,000.

Texas—Cities Service Oil Co, Mellie Esperson Bldg, Houston, plans constructing plant. $18,000,000. Defense Plant Corp will finance.

Texas—U S Eng, 416 Wright Bldg, Tulsa, Okla., receiving bids constructing imprvs, over $5,000,000; sanitary sewerage sys, facilities over $25,000; natural gas lines, facilities, over $25,000; water sys, facilities, over $15,000.

Texas—U S Eng, U S P O, Customhouse and Courthouse, Galveston, plans constructing school. Over $5,000,000. Myers & Noyes, and M Lemmon, Tower Petroleum Bldg, Dallas, engrs and archts.

Texas—U S Eng, Dist Eng, Federal Bldg, Galveston, plans constructing improvements, bldgs, etc. $6,000,000.

Texas—U S Eng, U S P O, Customhouse & Courthouse, 25 St and Avenue F, Galveston, plans constructing improvements. Over $5,000,000.

Texas—U S Eng, Federal Bldg, Galveston, plans by Finn, Stokes, Taylor & Bible, archts and engrs, 1005 Bankers Mortgage Bldg, Houston, and bids soon constructing improvements. $6,000,000.

Texas—University of Texas, plans constructing plant. $5,000,000. Federal financing.

Tex., College Station—Bids June 2, by A & M College, College Station, constructing power plant unit. $75,000.

Tex., Dallas—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., plans construction program, $1,500,000; improvements, $1,000,000.

Tex., Harlingen—M C Friel & Associates, c/o J E McDonald, State Agriculture Comr, Austin, plans constructing beet sugar refining plant, near here. $1,500,000.

Wash., Seattle—Bids June 11, by City raising Ross Dam (hydroelectric, variable arch) from 1360 to 1545 ft. Total est $8,000,000. E R Hoffman, city light supt.

Wash., Tacoma—Bids June 12, by Fed-

Less need to "patch and pray"

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condenser tubes of aluminum brass by Revere

With war production objectives far exceeding known supplies of materials, a warning has been sounded that many plants may have to "patch and pray" in order to keep their equipment in operation. That is why it is especially important now to use materials, such as Revalon condenser tubes, that stand up longer under difficult conditions.

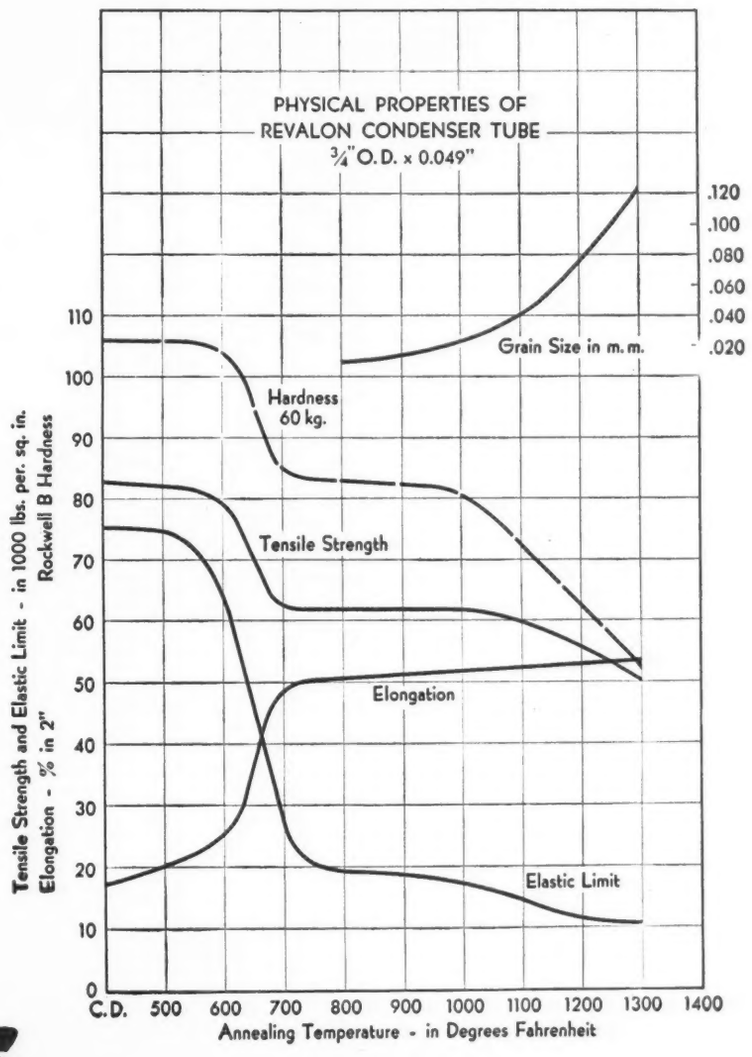
For power plants and central stations whose cooling water velocities are high, and especially where saline conditions exist, aluminum brass offers high resistance to impingement attack and erosion.

But sound tubes of aluminum brass are not easy to produce. There is an art to incorporating aluminum successfully into any copper-base alloy—an art which Revere metallurgists have brought to a high state of development.

In addition, Revere Revalon tubes are made by the extrusion process from solid cylindrical castings. Any internal casting defects tend to concentrate in the center of the casting, and are automatically rejected through the removal of a central plug of metal prior to extrusion. Likewise, any sub-surface imperfections or inclusions are left behind in the "skin" of metal remaining in the container after extrusion of the tube itself.

Naturally, these manufacturing methods are supported at Revere by every scientific means for analysis and test that is known to modern metallurgy. These highly advanced techniques provide users of Revere tubes with a product that is mechanically superior, free from surface and internal defects, and highly uniform in structure.

Revere condenser tubes and condenser tube plates are available in a number of alloys to meet every requirement of industry. The Revere Technical Advisory staff is always ready to help with your problems. Write us.



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2221

eral Works Agency, Alaska Bldg, Seattle, for two deepwell pump installations and reconditioning two existing installations, constructing two concrete pumphouses, Lakewood and Tillicum Dists south of here. FWA. $6,000 (final phase of $400,000 project). Parker & Hill, Smith Tower, Seattle, engrs.

Contracts Let

Arizona and Nevada—Bureau Reclamation, Kingman, Ariz., awarded contract constructing Davis Dam and power house, Colorado River, 30 mi west of Kingman, Ariz., Spec 1038, to Utah Constr Co, Ogden, Utah. $18,996,392. Est $20,000,000.

California—U S Eng, 751 S Figueroa St, Los Angeles, awarded contract constructing sewage-treatment plant, to Fritz Ziebarth, 820 W Esther St, Long Beach, less than $1,000,000.

California—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing improvements, bldgs, etc, to Los Angeles Contg Co & O W Karn, 4816 W Pico Blvd, Los Angeles, over $5,000,000. Kistner, Curtis & Wright, 665 Spreckles Bldg, San Diego, archts.

California—Yards & Docks, Navy Dept, 18 St and Constitution Ave N W, Wash., D. C., awarded contract, Supplemental Agreement 1, additional facilities, NOY 5125, to Barrett & Hilp, 918 Harrison St, San Francisco, $1,171,000.

Calif., Redding—Pacific Gas & Electric Co, 245 Market St, San Francisco, awarded contract constructing powerhouse bldg, related structures, Pit River No 5 Powerhouse, to H H Larsen Co, 64 South Park St, San Francisco. Exceeds $150,000.

Calif., San Diego — Federal Works Agency, 408 S Spring St, Los Angeles, awarded contract constructing El Monte Pipe Line for water supply sys, Calif, 4-140, Unit 8, Bid 6-RD-106, to American Pipe & Constr Co, 4635 Firestone Blvd, Los Angeles, $1,223,855.

Calif., Wilmington—Los Angeles City Dept, Water & Power, 207 S Bway, Los Angeles, awarded contract constructing superstructure Harbor Steam Plant, Spec 4162, to Zimmer Constr Co, 1227 S La Brea Blvd, Los Angeles, $459,000. Est $300,000.

Connecticut — Industrial co awarded contract constructing plant, to Turner Constr Co, 38 Newbury St, Boston, Mass. Est $3,000,000. Defense Plant Corp will finance. Albert Kahn, Inc, 345 New Center Bldg, Detroit, Mich., archt.

Connecticut — Industrial company awarded contract constructing temporary construction plant, to Hewlett Constr Co, 1385 Main St, Bridgeport. Federally financed.

Connecticut — Industrial co awarded contract constructing factory, to E J Pinney Co, Inc, 220 Dwight St, Springfield, Mass. Est $4,500,000 with equip. Defense Plant Corp will finance. J R Worcester & Co, 79 Milk St, Boston, engr.

Connecticut — Industrial company awarded contract constructing plant, to Lindholm Constr Co, Pittsfield, Mass. Est $2,000,000-$3,000,000. Singmaster & Breyer, 420 Lexington Ave, New York, engrs. Defense Plant Corp will finance.

Conn., Bridgeport—United Illuminating Co, 1119 Broad St, awarded contract constructing power-plant superstructure, Steel Point Station, to Gellatly Constr Co, 25 Housatonic Ave. Est $1,000,000.

Delaware—Industrial co awarded contract constructing factory to W F Trimble, 1719 Penn Ave, Pittsburgh, Pa. Est over

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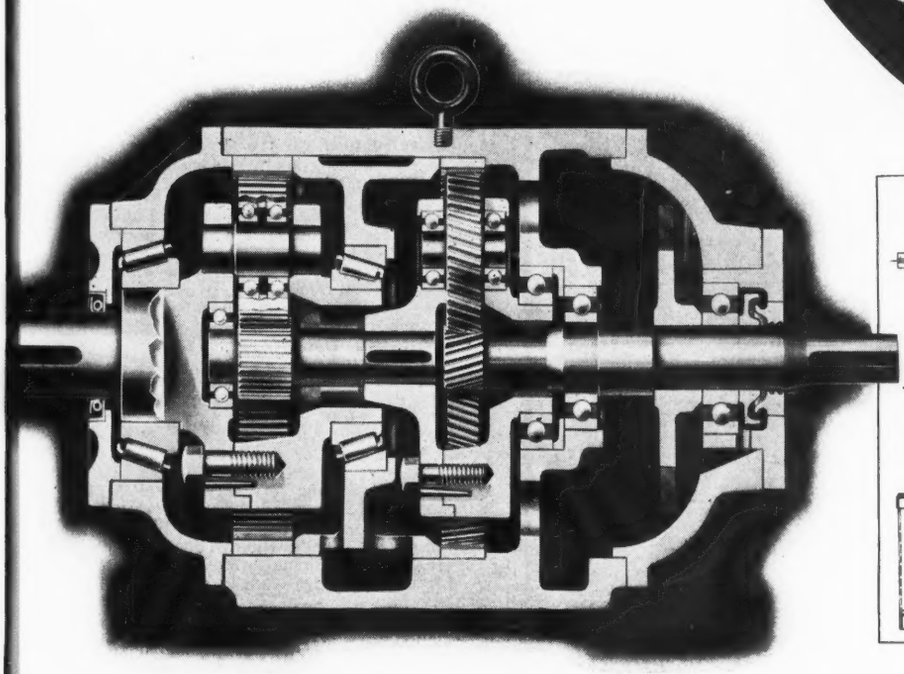
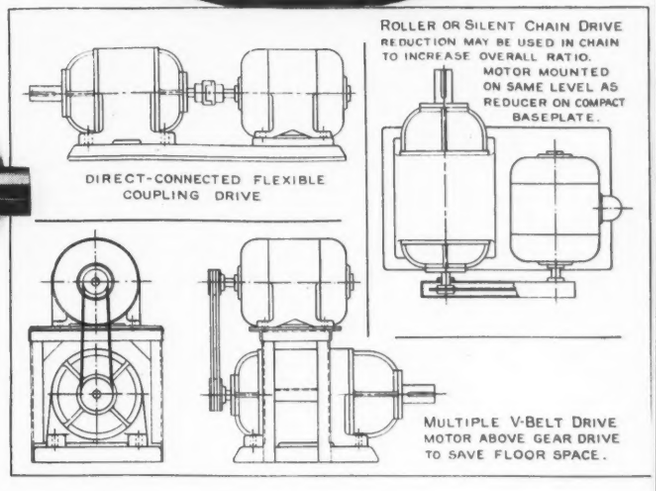
The Philadelphia Planetary Speed Reducer was designed to provide a straight line drive superior to the old spur gear type. In these units have been included many of the construction features, parts and precision manufacture that have made the Philadelphia MotoReduceR (the built-in drive) so widely preferred. These Planetary Units will give equal top-notch performance in those applications where a separate drive is desirable. They are compact yet rugged with a well balanced design. The accompanying sketches suggest several ways of mounting. Single, compound and double reduction types fit a wide range of requirements. For details send for catalog 100.

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REDUCTION MAY BE USED IN CHAIN TO INCREASE OVERALL RATIO.
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MOTOR ABOVE GEAR DRIVE TO SAVE FLOOR SPACE.

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LIMITORQUE VALVE CONTROLS

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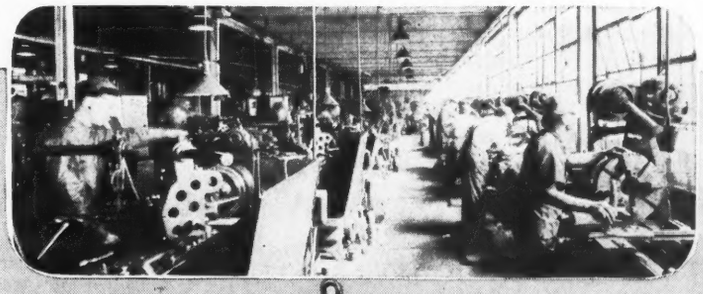

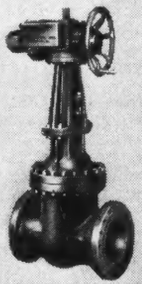

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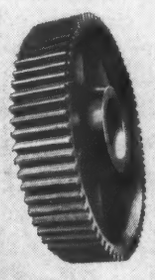
operates all types of valves, etc., safely, economically, from convenient stations.



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right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

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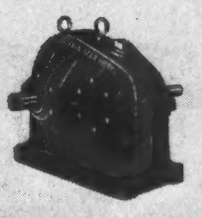
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.



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for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.

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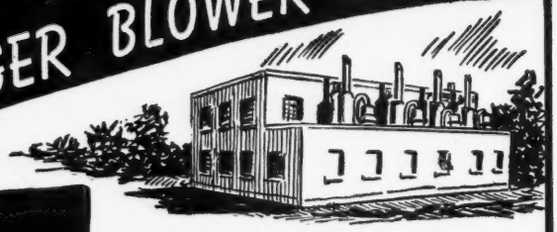
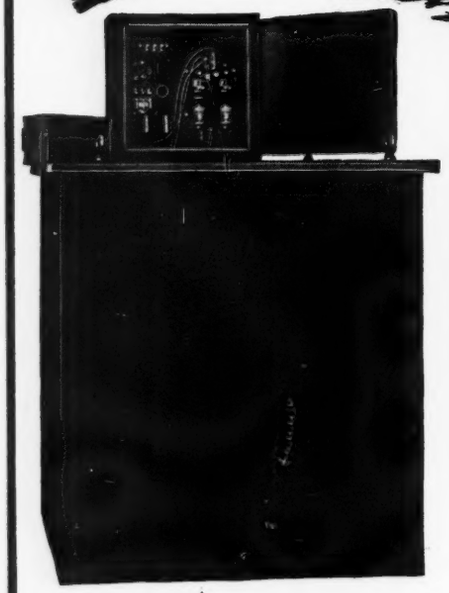
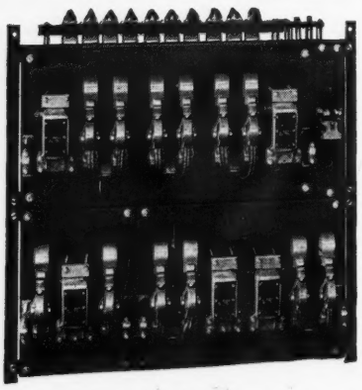
STARTER FOR Long-Time STARTING OF SCAVENGER BLOWER DRIVE







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Transition from reduced voltage to full line voltage is by EC&M NEO-TIME control, conveniently located in overload relay compartment. The enclosing cover for NEO-TIME panel setting on oil-tank cover is shown in view at left.

EC&M Type LZ Magnetic Contactors for handling the main motor circuit are shown in view at right. They are mounted in the oil-tank with auto-transformers and are completely oil-immersed. During transition, the circuit to the motor is not broken; instead, continuous torque is applied to the motor from the instant of starting.

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BRAKES MAGNETS LIMIT-STOPS MOTOR-CONTROL

$5,000,000. Defense Plant Corp will finance. C T Main, Inc, 201 Devonshire St, Boston, Mass., engr.

Florida—Yards & Docks, Navy Dept, 18 St and Constitution Ave, N W, Wash., D. C., awarded contract constructing imprvs, to F Howland, Inc, Postal Bldg, Miami and to A Orr, Jr, 218 N E 6 St, Miami. $4,350,000.

Fla., Mulberry—International Minerals & Chemicals Corp, 20 N Wacker Dr, Chicago, Ill., will construct plant, own forces. $3,250,000.

Georgia—Industrial company awarded contract constructing plant, for Navy Dept, to Mion Const Co, 377 Techwood Dr N W, Atlanta. Est $4,500,000. Philip M Jullien & Co, Southern Bldg, Wash., D. C., and W Elliott Dunwody, Macon, archts.

Illinois—Republic Steel Corp, 11800 S Burley Ave, awarded contract constructing power plant, to United Engineers & Contractors, Inc, 111 W Washington St. Est over $1,000,000. Federally financed.

Illinois—Texas Oil Co, McLeansboro, awarded contract constructing refinery, Hamilton Co, to Fluor Constr Co, Oshkosh, Wis. Est $1,000,000.

Ill., Chicago—Dept P Wks, awarded contract constructing piping, valves, etc Central Park Ave, Water Pump Station, to A Kilander & Co, 126 S Clinton St, $125,582.

Ill., Chicago—Republic Steel Corp, 11800 Burley Ave, awarded contract constructing power plant near 118 St and Burley Ave, to United Engineers & Constructors, 111 W Washington St. Est. $1,000,000.

Indiana—U S Eng, P O Box 59, Louisville, Ky., awarded contract constructing plant, to Esslinger-Misch Co, 159 E Columbia Ave, Detroit, Mich. general contract bldgs to G F Meyne Co, S Dearborn St, Chicago, Ill. Est over $5,000,000. Industrial Company will operate. W E Kapp, 712 Buhl Bldg, Detroit, Mich., archt.

Ind., Decatur—Bd P Wks awarded contract constructing cooling tower for light and power plant, to Schubert-Christy Corp, New Hampshire St and Frisco tracks, $37,500. Est $40,000.

Kansas—U S Eng, 601 Davidson Bldg, Kansas City, Mo., awarded contracts constructing improvements to M W Watson, Natl Bank of Topeka Bldg, Topeka. Est over $5,000,000. Burns & McDonnell, 107 W Linwood Blvd, Kansas City, Mo., archts.

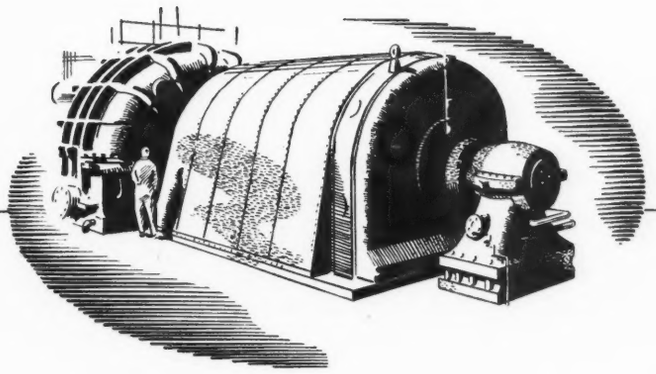
Kansas—U S Eng, 1709 Jackson St, Omaha, Neb., awarded contract constructing Sect 4, improvements, to Patti & MacDonald, 114 Bway, Kansas City, Mo. Approx $4,000,000.

Maryland—War Dept, 20 St and Constitution Ave N W, Wash., D. C., awarded contract constructing oil storage bldgs, utilities, to Blaw Knox Co, 342 Madison Ave, New York City, N. Y. Est less than $1,000,000.

Massachusetts—Industrial co awarded contract constructing plant, to M C Tuttle, 862 Park Square Bldg, Boston. Est $7,500,000. Defense Plant Corp will finance. Lockwood Greene Engineers, Inc, Federal St, Boston, engrs.

Mass., Taunton—City, Municipal Lighting Dpt, 55 Weir St, awarded contract constructing power plant, addn generating unit, Water St, to Vappi & Co, Inc, 240 Sidney St, Cambridge. Est over $40,000. A L Nelson, 31 St James Ave, Boston, engr.

Michigan—U S Eng, 613 Federal Bldg, Detroit, awarded contract constructing bldgs and electrical utilities to A H Proksch, Iron River. Est under $1,000,000.



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OPERATING data covering major turbine installations throughout the country are verifying daily the fact that Gulfcrest Oil gives unmatched performance in steam turbine lubrication. Here's the important reason:

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The most grueling tests—both in the laboratory and in actual service — have proved that the unequaled refining power of the Alchlor Process produces an oil which forms less gum and other harmful deposits, and less emulsion and sludge than any other turbine oil of which we have record.

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3. HIGHEST RESISTANCE TO ACIDITY AND SLUDGE. Because of the elimination of oxidation catalysts in addition to the unparalleled refining power of the Alchlor Process, these oils form less gum and deposits, less emulsion and sludge, when mixed with water over a period of several years continuous operation, than any other turbine oil of which we have record.

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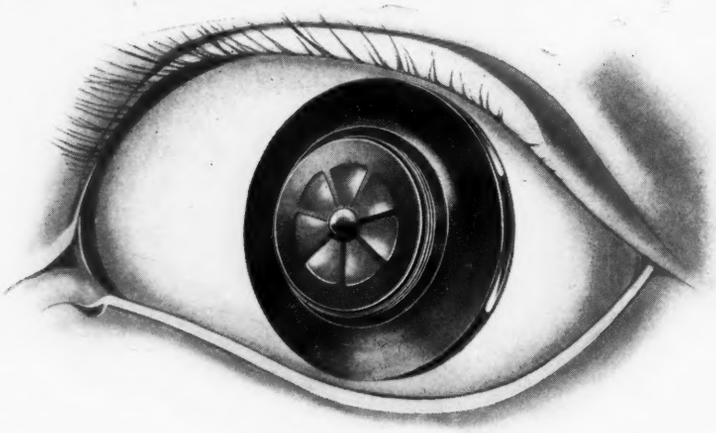

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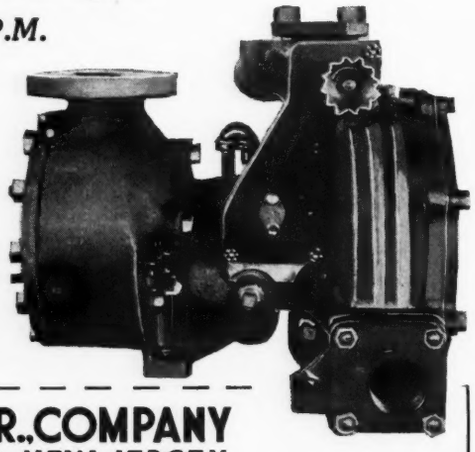
The peculiar, overlapping design of the inlet vanes provide two important features.

1. **A much smaller annulus diameter than the conventional axial inlet impeller of equal capacity.**
2. **An extremely smooth and unbroken water passage that results in the relatively gradual acceleration of the incoming stream, insuring freedom from erosion and a long impeller life.**

The pump of minimum size and weight FOR BOILER FEED AND GENERAL PRESSURE SERVICE.

PRESSURES TO—*750 Lbs. Per Sq. In.*

DELIVERIES TO—*500 G.P.M.*



Mail the Coupon

THE J. S. COFFIN, JR., COMPANY
ENGLEWOOD, NEW JERSEY

Please Send Descriptive Bulletin I-21

NAME

COMPANY

ADDRESS

P.W.

Minnesota—U S Eng, 1217 U S Post Office & Customhouse, St. Paul, constructing plant A-E-M contract, to E I Du Pont De Nemours & Co, du Pont Bldg, Wilmington, Dela. Over $3,000,000.

N. H., Portsmouth—City, Water Comrs, City Hall awarded contract for changes and constructing addns pumps stations, Haven and Sherburne pump stations, to Ralph P Hall, Inc, 141 Milk St, Boston, Mass. $49,352. FWA.

New Jersey — Industrial company awarded contract for design and construction addn to Bldg 2, Plant 5, and warehouse, to Walter Kidde Constructors Inc, 140 Cedar St, New York, N. Y. Defense Plant Corp will finance.

N. J., Newark—Federated Metals Div American Smelting & Refining Co, 150 St Charles St, awarded contract constructing electric precipitation plant bldge, 23x25 gas treater bldg, power house, concrete spray chamber, settling chamber, St Charles St, to W S Wilck, 280 Hobart St, Perth Amboy, $50,000.

New York—Industrial company awarded contract for design and construction plant, to Rust Engineering Co, Clark Bldg, Pittsburgh, Pa. Over $3,000,000. Federally financed.

North Carolina — Industrial company awarded contract constructing plant, for Navy Dept, to Sanderson & Porter, 1903 Liberty Life Bldg, Charlotte. $10,000,000.

Ohio—Industrial company awarded contract constructing plant, to Rust Engineering Co, Clark Bldg, Pittsburgh, Pa. Est $2,500,000. Defense Plant Corp will finance.

Ohio—U S Eng, 700 Union Guardian Bldg, Detroit, Mich., concrete work for plant to Horvitz Co, Midland Bldg, Cleveland * * * sewers, to National Constr Co, 12202 Superior Ave, Cleveland * * * railroad siding, to Stevens Const Co, 1276 W 3 St, Cleveland. Total est $5,000,000. Industrial Company will operate. CD 5/22-ENR 5/28, under CA.

Ohio—U S Eng, 700 Union Guardian Bldg, Detroit, Mich., awarded contract for construction-management, plant, to General Motors Corp, General Motors Bldg, Detroit, Mich. Over $3,000,000.

Ohio, Canton—Union Metal Mfg Co, 1432 Maple Ave, N E, awarded contract constructing power facilities expansion, power plant, to W A Landor, 716 25 St N E, $90,000; electric work, etc, to Hilscher-Clark Electrical Co, Canton. Total est $100,000.

Ohio, Newark—City will imprv sewerage sys erecting sewage disposal plant, WPA $2,000,000. C H Wells, city engr.

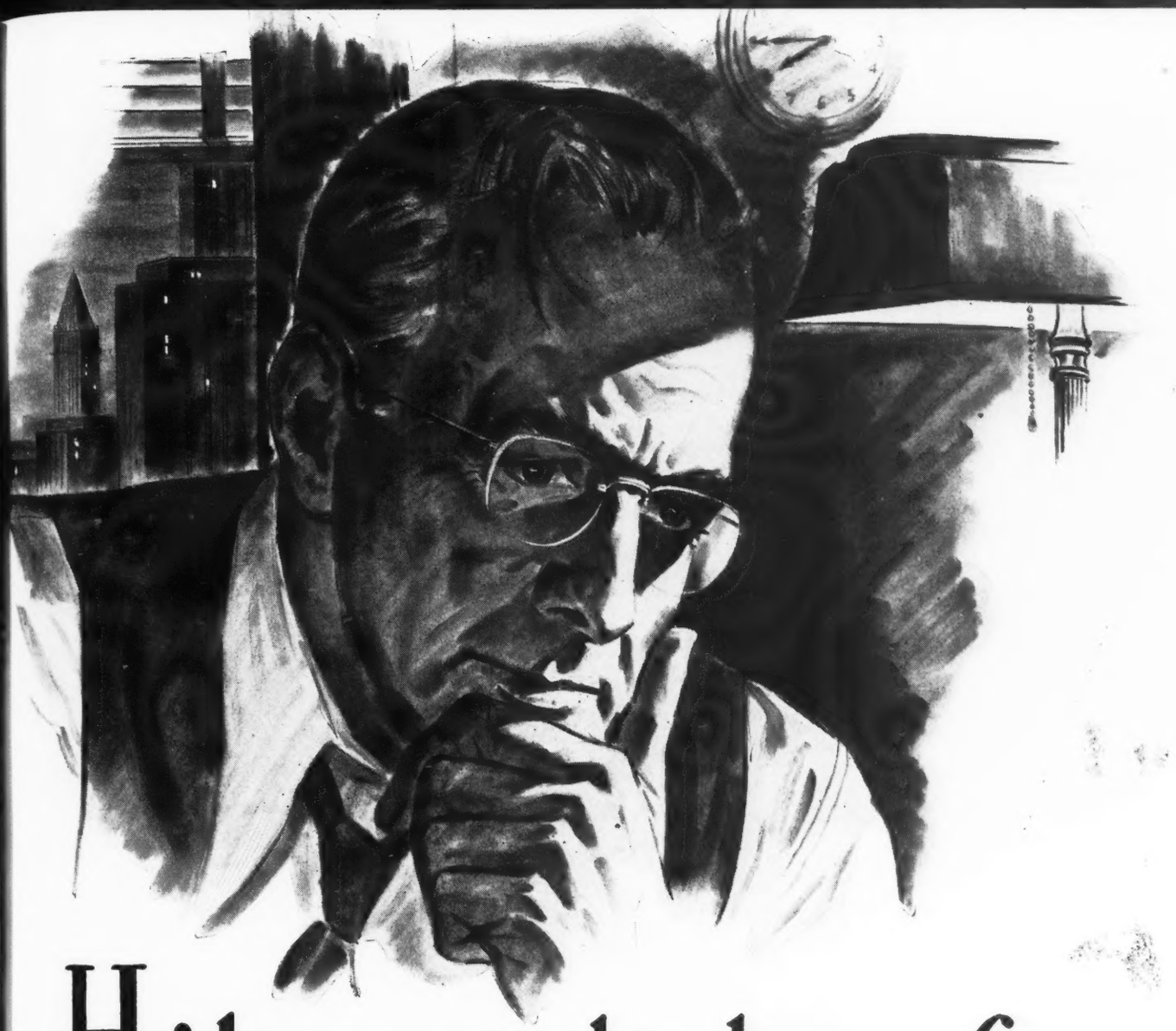
Oklahoma—Phillips Petroleum Co, Bartlesville, will construct plant $7,000,000; plant, $8,000,000. Owner builds. Defense Plant Corp will finance.

Pennsylvania — Industrial company awarded general contract constructing plant, to J M Baldwin, Whitfield Bldg, 5941 Baum Blvd, Pittsburgh; foundations, to Dravo Corp, Neville Island. Est between $1,000,000 and $5,000,000. Federally financed.

Pennsylvania — Industrial company awarded contract constructing plant, to John Stapf, 3365 N 6 St, Harrisburg. Exceeds $1,000,000. Federally financed. Ford, Bacon & Davis, Inc, 39 Bway, New York, N. Y., engrs.

Pennsylvania — Industrial company awarded contract constructing plant, to Rust Engineering Co, Clark Bldg, Pittsburgh. Est $1,000,000. Federally financed.

Pennsylvania — Industrial company awarded contract constructing superstructure mfg bldg, to American Bridge Co, Frick Bldg, Pittsburgh; grading, fdns



He'd even miss his dinner *for you*

CALL YOUR ELECTRUNITE DISTRIBUTOR FIRST!

Day or night, he's ready to help you on your boiler, condenser and heat exchanger tube problems. Your Republic ELECTRUNITE Distributor is going full out these days.

Because *Wartime Production* is taking more and more of his stock, he may not be able to deliver all the tubes you want when you want them. But he hasn't been caught "holding the bag." He has broadened his service and tuned it to the times. While it has made his job harder, it also has made his service more valuable to you.

He's working long hours studying customers' needs and analyzing available tube stocks to find the solution. He's usually able to deliver promptly the tubes needed for repairs in war production plants. If you are engaged in war work and require larger quantities of tubes for a new installation or for extensive repairs, he can arrange to get them for you.

You've nothing to lose and a lot to gain by calling your ELECTRUNITE Distributor *first.* Get acquainted with him today—and tell him your expected requirements so that he may anticipate your future needs. Be sure to give him complete details on how the tubes will be used and your preference rating or extension thereof. He must have this information to hasten deliveries.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
CLEVELAND • OHIO

Berger Manufacturing Division • Niles Steel Products Division
Union Drawn Steel Division • Culvert Division • Truscon Steel Company
• • Export Department: Chrysler Building, New York, New York • •

Republic

ELECTRUNITE

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REPUBLIC STEEL PRODUCTION FOR VICTORY

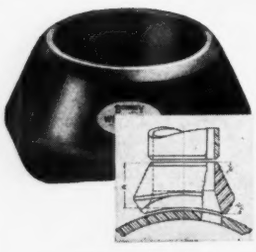
ELECTRIC RESISTANCE WELDED BOILER, CONDENSER AND HEAT EXCHANGER TUBES

WELDOLETS·
TRADE MARKS - REG. U. S. PAT. OFF.
THREDOLETS
. . . Welded Outlets for Piping . . .

How to Improve Flow Conditions in Piping Systems with Right-Angle Branch Pipe Outlets

ONLY with Bonney WeldOlets, ThredOlets or Socket-End WeldOlets is it possible to get the greatest degree of flow efficiency at 90° branch pipe take-offs.

Threaded tees, the accepted way of making 90° take-offs until the introduction of welded piping, provide flow conditions with such turbulence and friction caused by a sharp change of direction. However, installation is costly and unsatisfactory. Fig. 1 shows how the main pipe must be cut . . . the necessity for three threading operations (A) which cut away 40% of the pipe. In addition there is the strong possibility of leaks (B).



WELDOLET

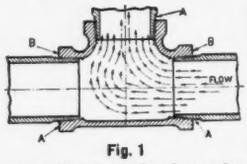
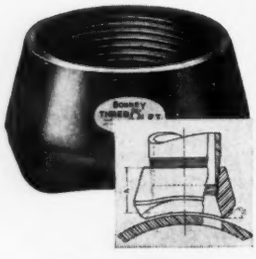


Fig. 1

Fig. 2 shows a pipe-to-pipe intersection weld which provides neither free flow nor strength at the junction (A). Sharp, right-angle turns (B) definitely restrict flow. Worse restrictions occur when the branch pipe extends into the main pipe (C). Other bad features are the large amount of weld metal required (D), the danger of icicles within the junction or of weld metal or scale passing through the system to clog valves and do other damage.



THREDOLET

Bonney WeldOlets, ThredOlets or Socket-End WeldOlets, Fig. 3, because of their heavy, external rib and wide bases, compensate for loss of strength in the main pipe when the button is removed (A) and provide junctions of full pipe strength which are absolutely leakproof. Free, unrestricted flow (B) is provided by their wide, funnel-shaped intake aperture. threading and fitting of the main pipe and the sharp 90° turn found in pipe-to-pipe intersection welds.

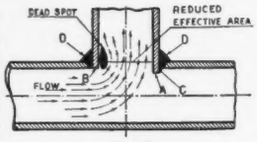


Fig. 2

They definitely eliminate

Standard, stock fittings (outlets from ¼" to 12") are drop forged steel and available for all standard pipe sizes. Or, on special order in sizes up to 24" x 24". They are suitable for every type of piping installation and for all commonly used pressures and temperatures.

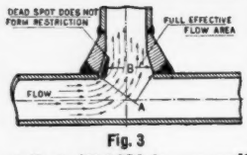
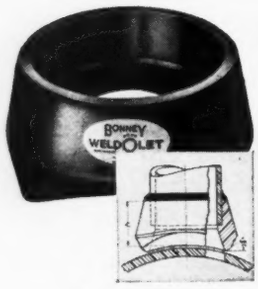


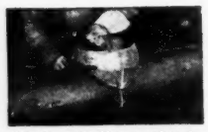
Fig. 3

Your local distributor will be glad to tell you the full story of WeldOlets, ThredOlets and Socket-End WeldOlets—or write for Bulletin WT29—TODAY.



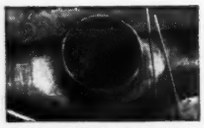
Socket-End WELDOLET

EASILY INSTALLED

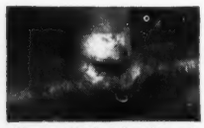


Mark center lines and tack the fittings into place.

Then weld the fitting to the main pipe.



Remove the button, which will also permit inspection of the inside of joint.



Then attach the branch pipe.

Bulletin WT29—20 pages packed with information and data on advantages of WeldOlets, ThredOlets and Socket-End WeldOlets in all types of piping installations. Write for your copy NOW.

BONNEY FORGE & TOOL WORKS
FORGED FITTINGS DIVISION
ALLENTOWN, PA.

paving, sewer, gas, water line to Holmes Const Co, 442 Palmer St, Wooster, O. Total est over $5,000,000. Federally financed.

Pennsylvania — Industrial company awarded contract constructing bldgs, for Navy Dept, to Stone & Webster Eng Corp, 49 Federal St, Boston, Mass. $14,000,000.

Tennessee—Industrial company awarded contract constructing plant, to L O Stocker Co, Arcade Bldg, St Louis, Mo, W J Knight & Co, Wainwright Bldg, St. Louis, Mo., engrs.

Tennessee—U S Eng, 307 U S Courthouse, Nashville, awarded contract for design and construction plant to H K Ferguson Co, Hanna Bldg, Cleveland. Est $25,000,000.

Texas—Goodyear Tire & Rubber Co, 1144 E Market St, Akron, O., awarded contract constructing plant bldgs, force account. $9,500,000. Est $18,000,000. Federally financed.

Texas — Industrial company awarded contract constructing plant, to Stone & Webster and Blodget, Inc, 49 Federal St, Boston, Mass. Approx $16,000,000. Defense Plant Corp will finance.

Texas—Industrial company, c/o contractor, awarded contract constructing plant to the Lummus Co, 420 Lexington Ave, New York, N. Y., $43,000,000 to $73,000,000. Defense Plant Corp will finance.

Texas—Republic Oil & Refining Corp, Texas City, will operate and construct plant. Approx $6,500,000. Defense Plant Corp will finance.

Va., Richmond—Virginia Electric & Power Co, 7 and Franklin St, awarded contract constructing steam power plant on James River, Chesterfield Co, 10 mi east of here, to Stone & Webster Eng Corp, 10 and Byrd Sts. $6,800,000.

Wash., Tacoma—Bd Contrs & Awards, City Hall, awarded contract for steel structures for Nisqually Line Terminal Exten, Tideflats substation, portion 2nd Nisqually Power development, to West Constr Co, Pier 11-B, Seattle, $1,604,218.

Power Lines

(*Continued from page* 128)

nounces that 125 companies have engaged space so far, and exhibitors are planning displays that will help the war production program by showing how to get more out of existing equipment, ways and means of preventing shutdowns and insuring continuous operation. It is expected that the exposition will provide a valuable and timely service to industry by helping to solve production problems.

As in the case of previous Power Shows, the forthcoming event, scheduled for Grand Central Palace, New York, November 30 to December 5, is under the management of International Exposition Company.

ABMA Annual Meeting

The American Boiler Manufacturers Association and Affiliated Industries held its fifty-fourth annual meeting at

Metal facts... Organized *for Production Victories*

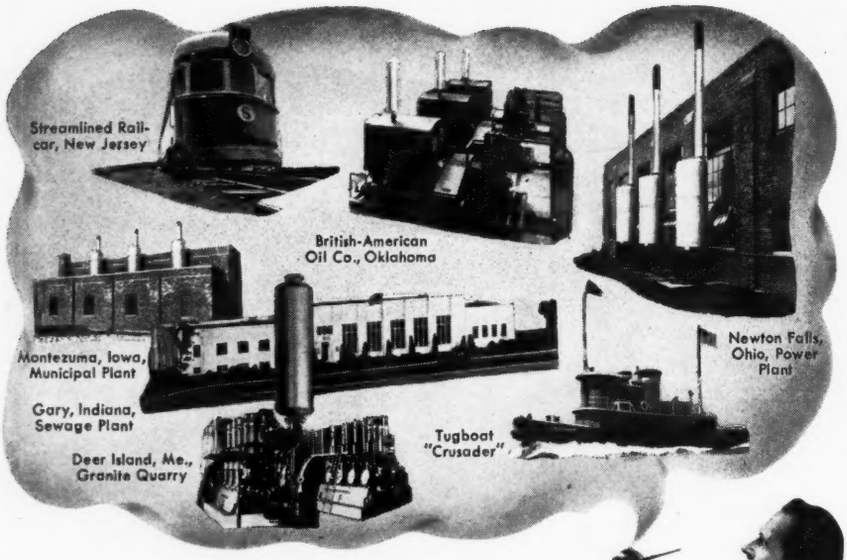
American industry...in the rush of converting its plants to war production...needs much new information about alloys. Such information...detailing the selection, fabrication and uses of ferrous and non-ferrous Nickel alloys...is available promptly from our files of technical reports and shop guides.

And, as further support in the battle of production, we offer the assistance of our engineering staff and field service men. Their recent experiences in many plants, their practical knowledge of ways to overcome shortages of materials, makes them especially helpful during wartime.

Nickel...and information about Nickel ...goes wherever they best speed Victory.

Nickel

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.


Streamlined Rail-car, New Jersey
British-American Oil Co., Oklahoma
Montezuma, Iowa, Municipal Plant
Newton Falls, Ohio, Power Plant
Gary, Indiana, Sewage Plant
Tugboat "Crusader"
Deer Island, Me., Granite Quarry

Diesel Engines with Quiet Exhausts are NO PIPE DREAM

Once upon a time Diesel engines meant Diesel exhaust noise, and exhaust noise complaints were common from persons living or working near these Diesel plants.

All this is now a thing of the past. Diesel engine owners are operating their engines, today, in residential districts, office buildings, and hotels. By equipping their engines with Burgess Exhaust Snubbers, they have done away with exhaust noise and all exhaust noise complaints.

The plants, shown above, are just a few of the many Burgess Snubber installations where Diesel engines are running without creating an exhaust noise nuisance. Burgess Snubbers—operating on the patented snubbing principle—have helped to popularize the use of Diesel engines in every kind of service. Any Diesel engine, anywhere, can be run without objectionable exhaust noise if it is equipped with a Burgess Exhaust Snubber. Burgess Battery Company, Acoustic Division, 2823-L West Roscoe St., Chicago, Ill.

Sectional view of Burgess STC Series Exhaust Snubber.

Originators of the Patented Snubbing Principle for Quieting Diesel Exhausts

BURGESS DIESEL EXHAUST SNUBBERS

"STANCO" PILLOW BLOCKS

Built for trouble-free service; machined faces, broached babbitted bore, ample lubrication. Full range of sizes.

Fig. 1635

"HALLOWELL" STEEL SHAFT COLLARS

Precision machined, fitted with "Unbrako" Self-Locking Set Screw—and low-priced.
Write for Details

Fig. 1432 Patented

STANDARD PRESSED STEEL CO.
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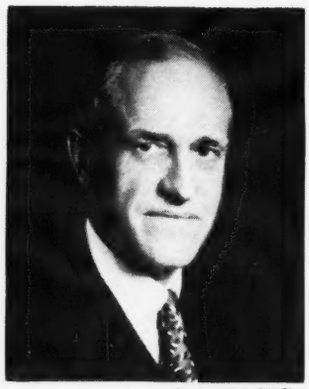


Greystone-Stoller Corp.

New President of ABMA & AI—F H Daniels, president, Riley Stoker Corp

the usual gathering place, Skytop Lodge, Skytop, Pa., June 1 to 3. The active members (manufacturers of power boilers, stokers, pulverizers, etc) and the associate members (makers of safety valves, blowoff valves, boiler tubes, and other boiler parts and attachments) held joint and independent sessions to discuss the manufacturing and business problems of the industries. Particular attention was given to meth-

New Vice President is A C Weigel, vice president, Combustion Engineering Co

ods of maintaining quality and production despite growing shortages of critical materials and manpower.

F H Daniels, president, Riley Stoker Corporation, Worcester, Mass., was elected president of the Association for the coming year. The new vice president is A C Weigel, vice president, Combustion Engineering Company, New York, N. Y. A C Baker ws re-elected secretary.

The Associate Members reelected their chairman, J P H DeWindt; also secretary P W Swain and treasurer A C Baker.

G-E Honors Three

Three General Electric engineers have been given Coffin Awards by the company "for outstanding group ac-

GLOBE STEEL TUBES

. . "IN THE SERVICE" ABOARD LIBERTY SHIPS

The "Liberty" ship construction program is one of the greatest mass production efforts in all shipbuilding history . . . Globe pressure tubes are part of the huge amount of equipment and materials required — and the Globe Steel Tubes Co. is proud to be identified with this historic "Victory" program.

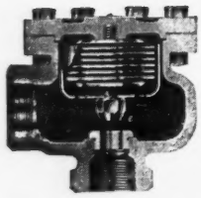
GLOBE STEEL TUBES CO., Milwaukee, Wisconsin

★ BOILER TUBES ★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING ★ STAINLESS TUBES

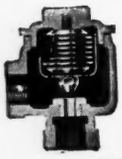
GLOBE TUBES

1001

★ ★ ★ War Power to You!

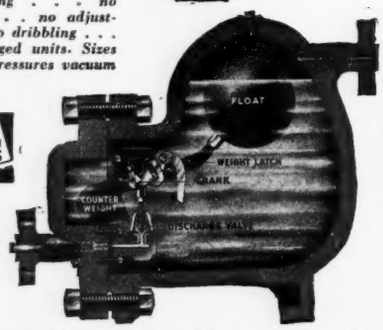


Install NICHOLSON TRAPS for MAXIMUM EFFICIENCY

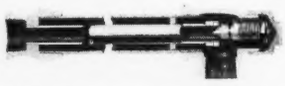


INDUSTRIAL THERMOSTATIC Traps in 4 types. No air-binding . . . no freeze-ups . . . no adjustment . . . no dribbling . . . no water-logged units. Sizes ¼" to 2". Pressures vacuum to 300 lbs.

SEE OUR CATALOG IN SWEET'S



Types for all power and process applications. Piston operated, instantaneous positive action — no wire drawing—pressures 2 to 650 lbs. Weight operated, large capacity—fully automatic—intermittent action—pressures vacuum to 1500 lbs. Expansion type, automatic—continuous discharge—adjustable for pressures to 225 lbs.



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Bulletins mailed promptly describing NICHOLSON Compressed Air Traps, Gasoline Traps, Steel and Stainless Steel Floats, Flexible Couplings, 2-3 and 4-way Valves, Compression Shaft Couplings, Expanding Mandrels, Arbor Presses, Steam Eliminators and Separators.

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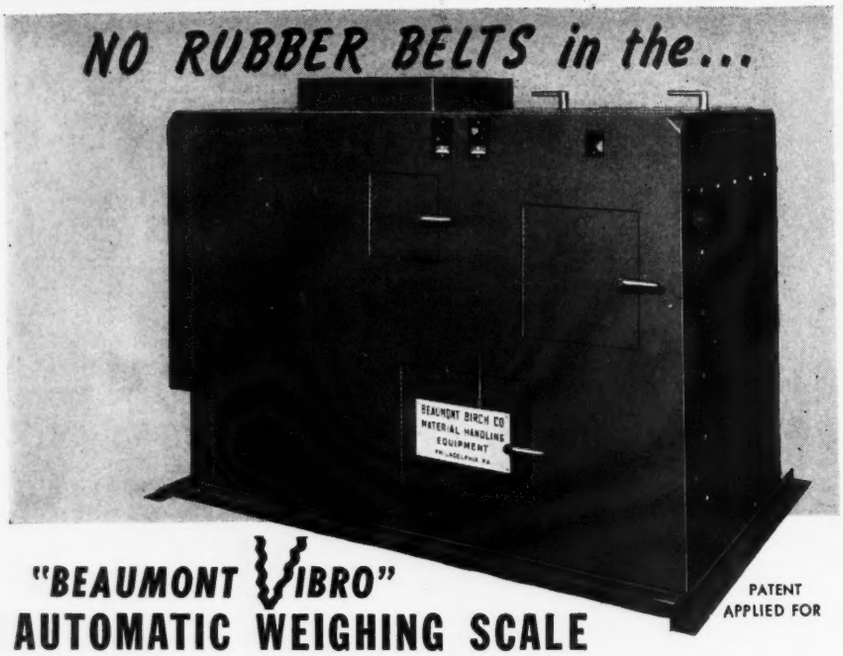

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PATENT APPLIED FOR

For accurately weighing coal and similar materials from 1 to 60 tons per hour. Simplified design eliminates all rubber belts, pulleys and motors. Totally enclosed and dustproof. By-pass chute prevents flooding and will operate instantaneously.

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1505 RACE STREET PHILADELPHIA, PA.
BULK MATERIAL HANDLING EQUIPMENT

complishment in bringing the turbosupercharger enterprise through highly critical years to its present great value in the war effort."

S R Puffer, designing enigneer of the supercharger department, was cited for his "sustained, steadfast, and sound engineering direction."

Waverly A Reeves was cited for "his courage and resourcefulness in observing and overcoming critical difficulties in test flights."

Dr C W Smith, technical supervisor of the supercharger department, was honored for "his speedy and accurate solution of difficult technical problems by developing new test methods and correlating observations with theory.

Mr Reeves took part in the original altitude test of a turbosupercharger attached to a Liberty engine at the top of Pike's Peak in the fall of 1918 and later in several stratosphere flights. Mr Puffer and Dr Smith are also veterans of the department.

The awards are given annually to General Electric workers for unusual achievements by a foundation established by the late Charles A Coffin, first president of the company. Winners receive money awards and certificates.

How to Maintain Electric Motors

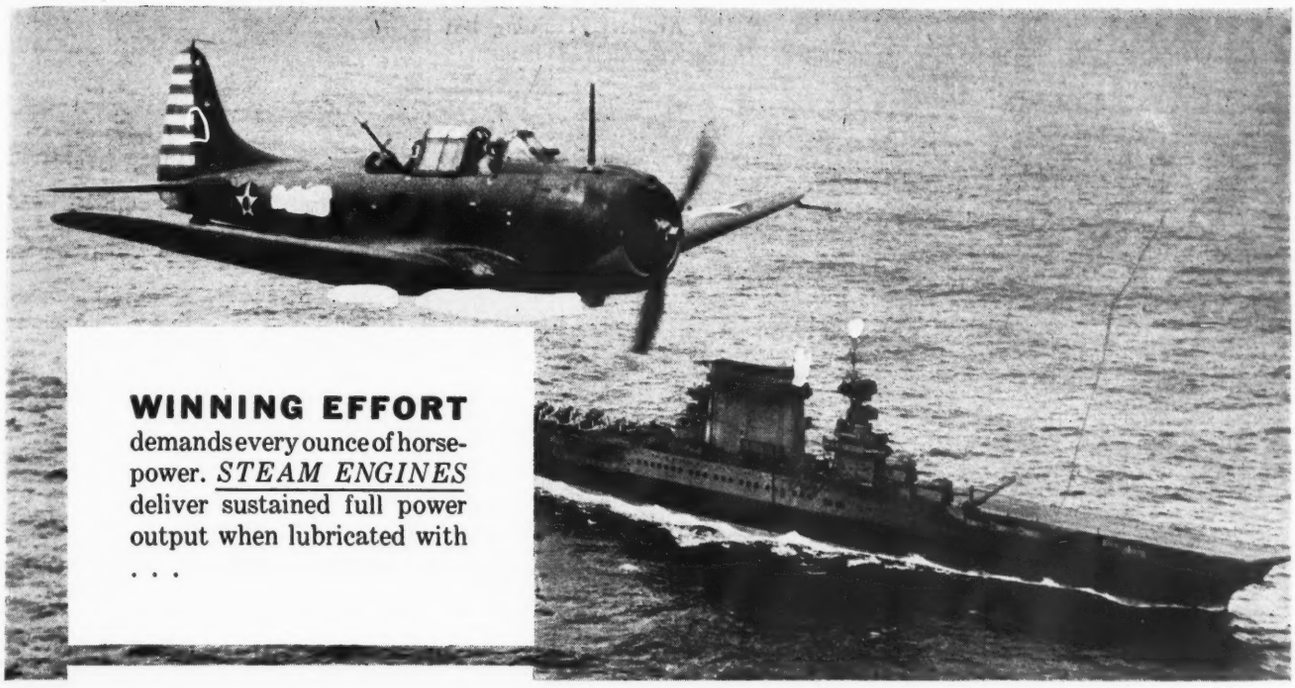
With many plants operating 24 hours per day, 7 days a week, the nation's power engineers face a pressing problem in maintaining equipment such as motors to meet the demands of continuous service. To satisfy this urgent need, the Allis-Chalmers Mfg Co has just issued a new handbook "A Guide to Wartime Care of Electric Motors".

Taking a fresh slant on the care of motors under war conditions, the book should prove of value to engineers and maintenance men, and in training new operators. The handbook is an impartial study of all types of motors, and is available free upon request to the Allis-Chalmers Mfg Co, Milwaukee, Wis.

IN THE SERVICE

From information received the past month, POWER here presents a brief summary of power men who have left their business positions to enter the armed services. No attempt has been made to list these in any preferential order.

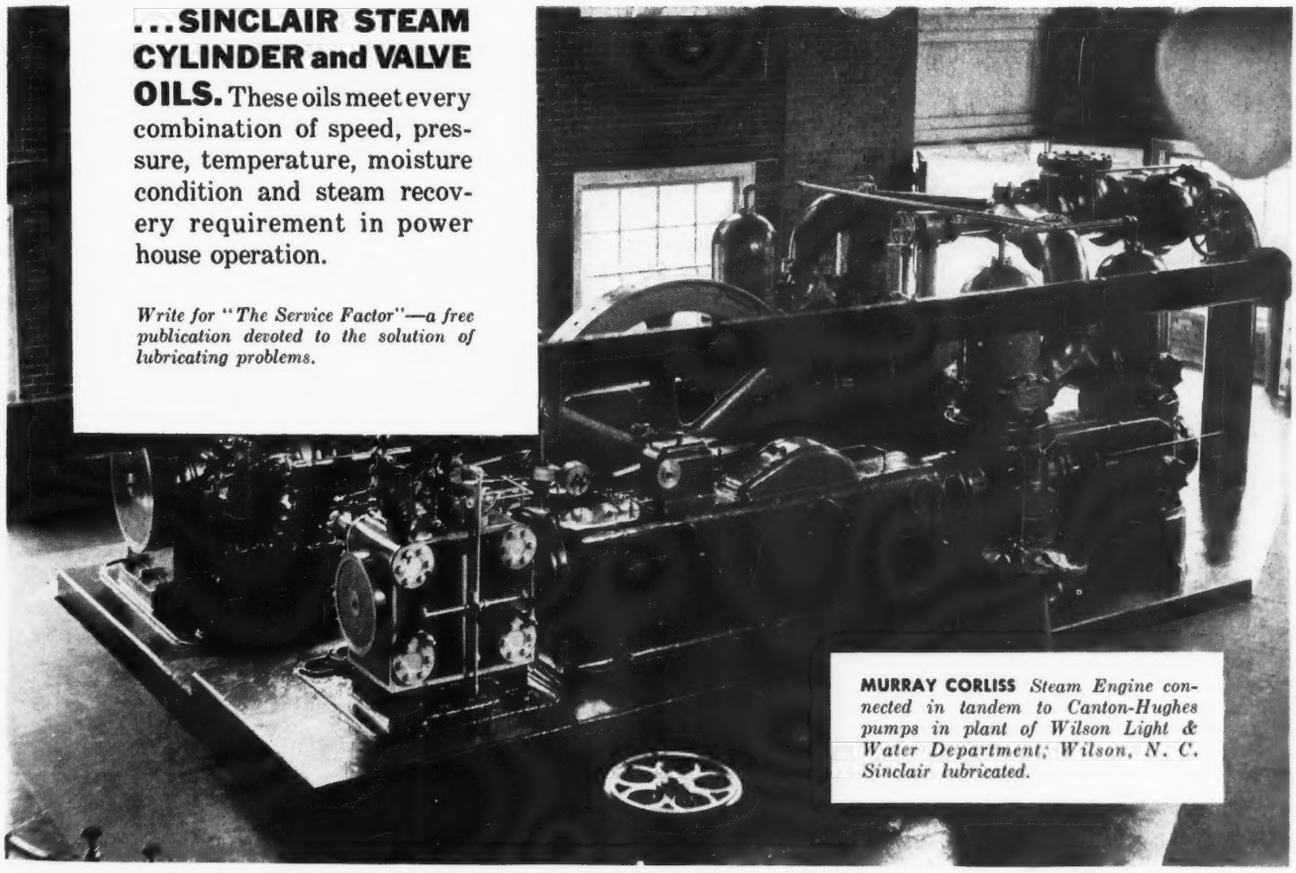
WILLIAM A ROEVER. From sales engineer, Clark Bros Co Inc, Olean,



WINNING EFFORT demands every ounce of horsepower. *STEAM ENGINES* deliver sustained full power output when lubricated with . . .

. . . SINCLAIR STEAM CYLINDER and VALVE OILS. These oils meet every combination of speed, pressure, temperature, moisture condition and steam recovery requirement in power house operation.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



MURRAY CORLISS *Steam Engine connected in tandem to Canton-Hughes pumps in plant of Wilson Light & Water Department, Wilson, N. C. Sinclair lubricated.*

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

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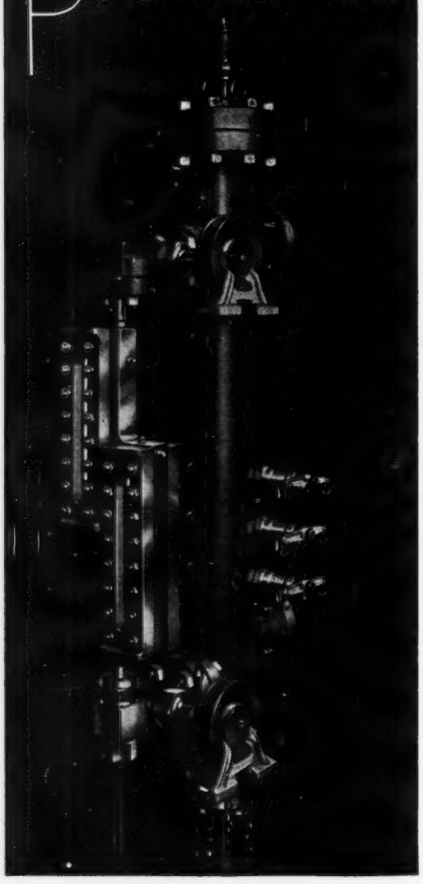
POSITIVE
Protection



Yarway's unique Hi-Lo Alarm mechanism utilizes balanced *solid weights* that are as indestructible and unchanging as the metal itself. Operating on the displacement principle, they literally "weigh the water level."

When the high or low water emergency occurs—instant, positive, powerful, hair-trigger *action* results—giving warning of danger by whistle, light, or both.

Yarway Water Columns, eight standard models, iron bodies with screwed connections for pressures up to 250 lbs., forged steel bodies with flanged connections for pressures up to 1500 lbs., are fully described in Catalog WG-1808. Write for a copy and working model.

YARNALL-WARING COMPANY
100 Mermaid Ave. Philadelphia

YARWAY
FLOATLESS HI-LO ALARM
WATER COLUMN

N Y, to 31st Artillery, Training Battalion, U S Coast Artillery, as lieutenant.

ROBERT T KAIN. From sales engineer, belting department, B F Goodrich Co, Akron, Ohio, to United States Navy as lieutenant, junior grade.

DON ALLSHOUSE. From advertising manager, Northern Equipment Co, Erie, Pa, to U S Army Air Force as lieutenant.

JOHN S GULLEDGE. From St Louis district manager of the industrial products sales division, B F Goodrich Co, Akron, Ohio, to Army Air Corps.

BERN DIBNER. From vice president and general manager, the Burndy Engineering Co, 459 East 133 St, New York, N Y, to U S Air Corps as captain.

WPB Now Controls Equipment Distribution

The War Production Board has assumed control over the distribution of many types of general industrial equipment so that they will be directed into war channels.

The order, L-123, affects such machinery as passenger and freight elevators, electric motors of more than one horsepower, industrial fans, industrial compressors and pumps, and a number of other classes of machinery used generally in various industrial operations. Some types of machinery within these classes are covered by other WPB orders and are therefore not restricted under L-123.

The order provides that no one may accept any order for or deliver any equipment listed in the 14 classes set forth except upon a preference rating of A-9 or higher or upon specific authorization of the Director of Industry Operations.

Manufacturers may ship machinery to distributors only to fill approved orders actually received by distributors or to replace machinery delivered by a distributor on an approved order.

Manufacturers and distributors who have orders on their books which do not fall within the approved classification may appeal to WPB for permission to dispose of those orders by listing them, giving the name of the prospective purchaser or lessee, a complete description of the machinery and its value, the use for which it is intended, and other pertinent data.

Restrictions contained in the order do not apply to deliveries of repair parts worth less than $1,000 for use in maintaining a single piece of existing

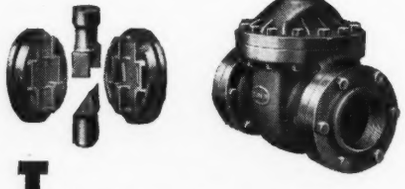
NO MAGIC CARPET BUT...

This blitz buggy can do amazing things! Rugged, compact and always ready for action, it passes the most severe test with colors flying.

The same is true of Ludlow Valves. Today, in vital power plants and manufacturing centers that help sustain our war effort, they're rendering yeoman service . . . taking tough assignments in stride. These rugged valves employ the famous double-disc, parallel seat principle, developed and perfected by Ludlow. This insures smooth operation, tight closure—whether the valve is in action every few minutes or only in emergencies. In peace or war, *LUDLOW means value in valves.* Write for Catalog.

THE LUDLOW VALVE MFG. CO., INC.
Troy, New York

Construction Features: Self-releasing 30° angle wedges and free-floating gates, self-adjusting to seats, afford smooth, trouble-free performance, long service. Rings are cleaned throughout stroke action. Gates are wedge-locked directly opposite ports and completely unwedged before raising. Ample tolerances provide easy action. Simple construction permits easy replacement of parts.



LUDLOW VALVES
SINCE 1866

Automatic ELECTRIC EQUIPMENT

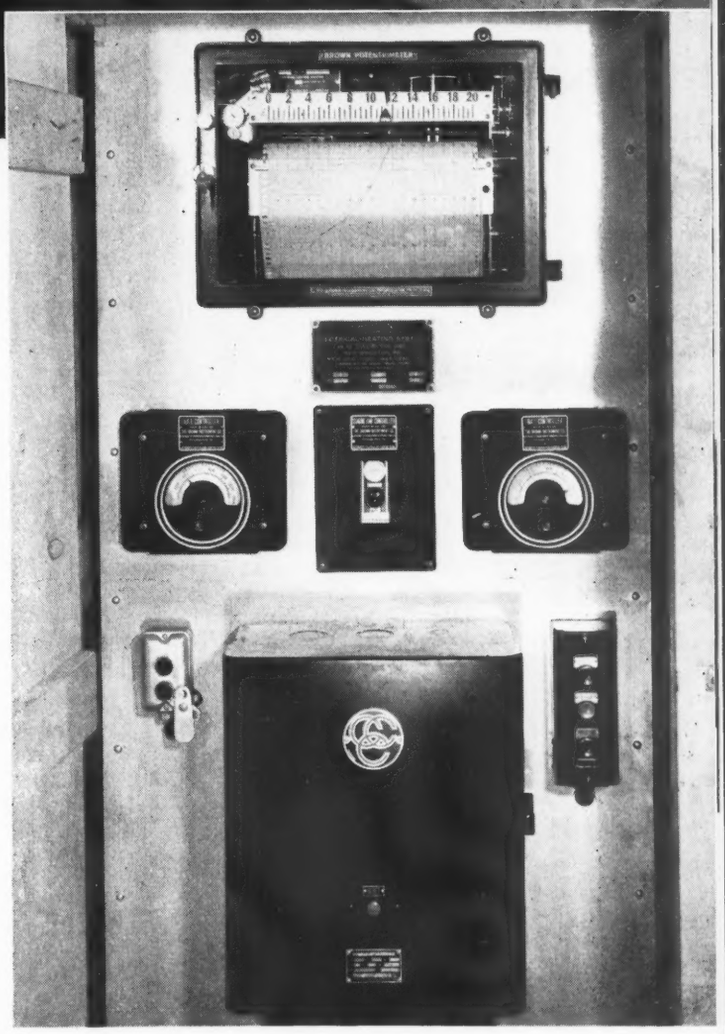
for accurate control of pre-heating and stress-relieving

. . . . . guarantees better, safer high temperature, high pressure piping fabrication

IN modern high pressure, high temperature systems, the universal use of welding places great importance on the correct welding procedure. Pittsburgh Piping has pioneered in the use of specialized control equipment to insure high quality workmanship.

The illustrations on this page show one type of electrical equipment used at Pittsburgh Piping to automatically control the temperature of the pipe within ±10°F for any desired range. As illustrated, it is being used to preheat the piping while being shop-welded. After welding, a few minor adjustments, and the equipment is ready for stress relieving the joint. The pipe is heated, held at the desired peak, and cooled —all in accordance with a predetermined time-temperature relationship.

Such thoroughness of control eliminates guesswork and results in much safer piping.



PITTSBURGH PIPING & EQUIPMENT CO.
10 FORTY-THIRD STREET PITTSBURGH, PA.

Woolworth Bldg., New York Occidental Bldg., Indianapolis Peoples Gas Bldg., Chicago Union Guardian Bldg., Detroit
Public Sq. Bldg., Cleveland 10 High St., Boston 525 Market St., San Francisco

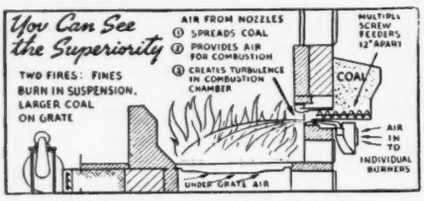
Pittsburgh Piping

FYR-FEEDER

MULTIPLE SPREADER STOKERS

OIL BURNER Users-Vital Industrial Plants -Get QUICK DELIVERY

FUEL Shortage, Steam Shortage, Man-power Shortage problems find a quick, efficient solution when you install the multiple FYR-FEEDER Spreader Stoker! Burns local coals—excellent results with cheapest grades—more steam, less work, no clinkers. Our engineers will be glad to help you make application to qualify for *IMMEDIATE DELIVERY*. Write to AMERICAN COAL BURNER CO., ENGINEERS, 32-18 East Erie St., Chicago, Ill.


You Can See the Superiority
AIR FROM NOZZLES
① SPREADS COAL
② PROVIDES AIR FOR COMBUSTION
③ CREATES TURBULENCE IN COMBUSTION CHAMBER
TWO FIRES: FINES BURN IN SUSPENSION, LARGER COAL ON GRATE
MULTIPLE SCREW FEEDERS, 12" APART
COAL
AIR IN TO INDIVIDUAL BURNERS
UNDER GRATE AIR

MULTIPLE BURNER SPREADERS ARE ADVANTAGEOUS AND NECESSARY

Each FYR-FEEDER has 2, or 4, or more burner spreaders giving dependability and convenience in cleaning grates, impossible to secure with a single spreader.

TERRITORIES FOR SALES ENGINEERS

Some territories are open for experienced sales engineers familiar with steam plant boilers and furnaces. Information on request. Please furnish record of your experience and references.

AMERICAN COAL BURNER COMPANY,
Engineers
32-18 East Erie St., Chicago, Ill.

☐ YES, I want to know what the FYR-FEEDER can do in our plant.
☐ Please mail descriptive literature.
☐ I am interested in selling FYR-FEEDERS.

Name .....

Company .....

Address .....

equipment, or repair parts worth more than $1,000 in cases where an actual breakdown or suspension of operations has occurred as a result of damage to machinery.

Steel Information

Technical information on the National Emergency Steels is accumulating and is available to industry, it was announced by the Metallurgical Section, Iron and Steel Branch, and the Bureau of Industrial Conservation, who are cooperating on the proposed new specifications.

Increasing use of the steels has made them more readily available at steel mills and warehouses and numerous tests have been made. In addition, steel companies have been making physical tests on the new steels as they are produced. Some of the tests have been made on single heats, but others have been made on several sizes and after various heat treatments.

To make the information available to industry, the Iron and Steel Institute has collected all existing data and published it in loose leaf form. Included are curves showing the hardenability characteristics of all NE steels and the mechanical properties of a number of the compositions. Present data will be supplemented from time to time as testing of the steels continues.

National emergency steels are made in accordance with new specifications designed to conserve scarce alloying elements.

Instruments, Regulators Controlled by WPB

In a move to conserve nickel, chromium and their alloys, the War Production Board has assumed control over the production and distribution of many types of instruments, regulators and control valves used in general industrial processing and in the manufacture of war material.

Many of these instruments, highly technical in character, are required by war industries. With the assistance of technical personnel of all interested Government agencies, and of the industry, WPB's General Industrial Equipment Branch has drafted specifications for the production of various types of instruments and restrictions on their use, which are incorporated in Conservation Order L-134.

The order covers 28 specific items forming component parts of industrial processing instruments and valves and regulators. In certain cases, it restricts the size and maximum chromium and nickel alloy content of these items. In

WHY WAIT ?

YOU CAN GET PROMPT DELIVERIES ON *PALMETTO and our other PACKINGS

In spite of war demands... in spite of a record volume of business...we are making all shipments on schedule.

Avoid disappointments
ORDER PALMETTO TODAY

WRITE FOR LITERATURE

GREENE, TWEED & COMPANY
Bronx Blvd. at 238th St., New York, N. Y.

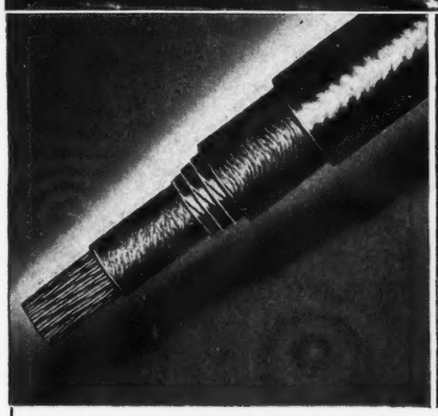
TWISTED
For valve stems; each strand a perfect piece of lubricated packing.

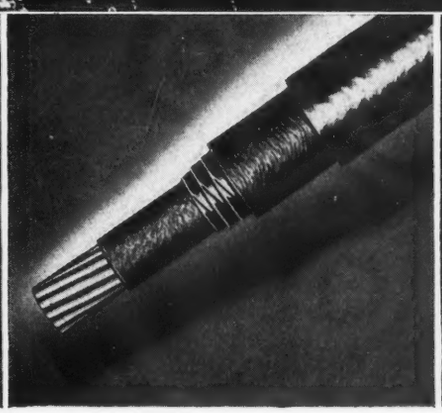
BRAIDED
For rods and shafts; layer over layer construction insures uniformly even bearing surfaces.

*Reg. U. S. Pat. Off.

PALMETTO
for steam, hot water, air. PALCO *for water.*
PELRO *for oils.* CUTNO *for alkalis.*
SUPERCUTNO *(blue asbestos) for acids.*
KLERO *for foods.*
SELF-LUBRICATING
PACKINGS

For the Hot Spots in the "HOT" industries





FOR YOUR MOTORS
Rockbestos A. V. C. Motor Lead Cable
For coil connections, motor and transformer leads. Resists heat, flame, moisture, oil and grease. Insulated with felted asbestos, varnished cambric, felted asbestos and asbestos braid. Sizes: No. 18 AWG to 1,000 MCM — 600 volt. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

FOR YOUR POWER CIRCUITS
Rockbestos A. V. C. Power Cable
For power circuits and hot spot wiring in boiler rooms, steam tunnels, etc. Felted asbestos and varnished cambric insulation is heat, flame and moisture resistant. 600 to 8000 volt ratings. No. 18 AWG to 1,000 MCM, 600 volt. Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

FOR YOUR LIGHTING CIRCUITS
Rockbestos A. V. C. Boiler Room Wire
For lighting and control circuits exposed to heat, moisture, corrosive fumes, oil, grease and fire hazard. Insulated with varnished cambric, felted asbestos and asbestos braid. Sizes: No. 18 AWG to 4/0 — 600 volt (No. 6 to 4/0 insulated like power cable). Underwriters' and Nat. Elec. Code Type AVA, max. operating temp. 110°C. (230°F.).

24 hour full-blast days mean: 3 times as many wire failures and 3 times as much lost production — *eliminate the failures* and you save the production! The simplest and surest way is to use Rockbestos A. V. C. wire and cable around boilers, steam lines, furnaces, lehrs, ovens, soaking pits and other *hot spots* where heat, fire, corrosive fumes, moisture, oil and grease cause frequent wire failures. Rockbestos A. V. C. is made especially for *severe* service. Its insulation stands up *permanently* because it won't bake out, crack, bloom, flow, rot or burn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

Send in preference rating papers and end-use classification when ordering. Keep your requirements to the minimum. Catalog and samples on request.

ROCKBESTOS PRODUCTS CORP., 855 NICOLL ST., NEW HAVEN, CONN.

New York • Buffalo • Cleveland • Chicago • Pittsburgh • St. Louis • Los Angeles • San Francisco • Seattle • Portland, Ore.

NEED VIKING SERVICE?

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VIKING REPRESENTATIVE

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Do you have a pump maintenance problem? Is your pumping installation operating with highest efficency? Viking's nation-wide sales and service organization would like to help you. Write or call the Viking representative nearest your plant:

CHICAGO
Viking Pump Company
549 W. Washington Blvd.
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Viking Pump Company
310 Marshall Building
Phone Cherry 0687

INDIANAPOLIS
Viking Pump Company
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Phone Lincoln 4788

BALTIMORE
Wallace Stebbins Company
Charles & Lombard Sts.

BOISE
The Olson Manufacturing Co.
P. O. Box 1487

BOSTON
Hayes Pump & Machinery Co.
125 Purchase St.

BUFFALO
Root, Neal & Company
64 Peabody Street

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William T. Johnston Co.
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Viking Pump Company
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Viking Pump Company
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LOUISVILLE
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505 W. Main Street

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SAN FRANCISCO
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VIKING
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CEDAR FALLS, IOWA

addition, it limits the use of instruments containing these critical materials to certain specified operating conditions.

The order outlines manufacturing specifications for various types of instrument parts, such as valves, nozzles, protective tubings, thermocouples, sockets, etc., and sets forth the use to which these parts may be put.

Under the general restrictions, manufacturers are prohibited from processing any chromium, nickel or alloys of these metals in producing any instrument parts except for use under the operating conditions specified. Thirty days after the date of order's issuance (May 26), manufacturers may not deliver any parts except for the specified uses. Effective immediately, they cannot deliver these instrument parts, no matter what the intended use is, except upon a preference rating of A-10 or higher.

Manufacturing specifications set forth in the order take effect 60 days after the date of issuance. After that time, manufacturers must follow these specifications as well as restrict their production to instrument parts designed for the specified operating conditions.

The order also prohibits any person from accepting delivery of any instrument part unless he expects to install the item which is being delivered, and all similar items on hand, within the next 90 days. Persons receiving these parts must certify to manufacturers or distributors that the equipment received will be used only in the operating conditions permitted under the terms of the order.

The order does not apply to any instrument which does not contain nickel, chromium or their alloys, or instruments manufactured prior to May 26. Deliveries intended for the Army, Navy and Maritime Commission will not be affected by the restrictions until 90 days after the issuance date.

Fuel Oil Use Restricted Severely by Order L-56

Users of fuel oil in the Eastern States, and to some extent in the Midwest and Northwest, were placed under severe restrictions by "Amended Limitation Order L-56" made effective May 16 by J S Knowlson, Director of Industry Operations, War Production Board.

Basic to the order is the establishment of three areas defined as follows:

Area One:

(a) Entire eastern part of U. S., up to and including all of the counties of Wayne, Ontario and Steuben in New York; Tioga, Lycoming, Clinton, Centre, Blair and Bedford in

WORRIED . . . Yes, that Turbine oil is bad, full of sludge and acids. Will you throw it away or will you take a chance? Disaster strikes fast, one bearing and she's done, your turbine is ruined.

PLAY SAFE . . . Call a Honan-Crane Engineer. A Honan-Crane *"Continuous"* Oil Purifier will safely remove all contamination and restore the oil to its original efficiency while the turbine runs. You can save your oil with no danger of turbine failure.

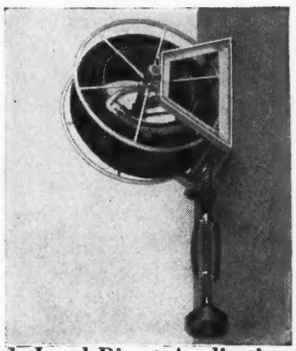
CONTROL . . . The flick of the switch on a Honan-Crane *"Continuous"* Oil Purifier gives you perfect *control* of the oil in Turbine and Hydro-Electric Generators. You can *safely* keep the oil entirely clean and in perfect lubricating condition. All contamination is removed from the oil. For information write for Bulletin 300TP.

HONAN-CRANE CORPORATION
OFFICES IN PRINCIPAL CITIES
LEBANON, INDIANA

ADVANCED IN ENGINEERING AND DESIGN

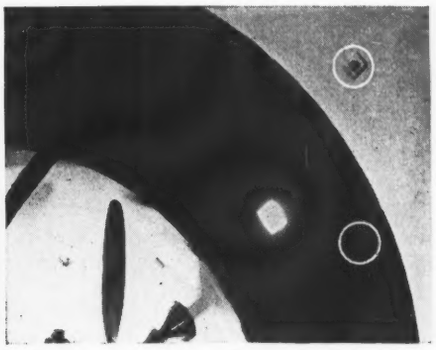
IN CASE OF FIRE

3 METHODS OF EXTINGUISHMENT *WITHOUT* EXTINGUISHMENT DAMAGE



1. Local Direct Application: *Cardox playpipe and hosereel for a wide variety of hazards. Easy to handle; supply from central storage of tons of low temperature CO_2.*

2. Manual Electric Control: *Cardox Pushbutton Station, for manual control of systems using visual detection of fire; delivers a timed discharge from a Cardox central storage unit holding tons of cold CO_2.*



3. Fully Automatic: *Cardox System, with heat detectors to actuate alarms, close doors, close down fans and equipment and deliver timed discharge from a Cardox central storage unit holding tons of cold CO_2.*

IN case of *any* fire—from engine fires in test cells or plant sabotage, to air raids—Cardox can safeguard operating schedules. Applications of the three methods pictured above are being engineered in every combination to guard constantly against *fire interruption.*

Damaging fires can destroy planes, hangars, instruments, representing months of work—or knock out production facilities *for months to come.* Cardox, with low temperature liquid carbon-dioxide as the extinguishing medium, "cools out" fire *without* extinguishing damage. Machines, material and men can be back at work in a few minutes!

Always when the fire is over there is somebody to point out *how little* of someone's time and effort it would have taken to forestall the fire. Take that little time now to get all data on Cardox. Write for Bulletin 53.

How CARDOX Extinguishes Fires

- *A timed, mass discharge of Cardox CO_2 "knocks down" fire, by...*
- *Reducing Oxygen content of the atmosphere below the concentration necessary for combustion, and...*
- *Cooling combustibles and fire zone below ignition temperature...*
- *Extinguishing fire quickly, completely and entirely without damage from extinguishing medium.*

CARDOX—CO_2 Systems with Enhanced Fire Extinguishing Performance

- **A** *Uniformity of CO_2 characteristics.*
- **B** *Extinguishing medium with greater cooling capacity.*
- **C** *Accurate projection of CO_2 through greater distances.*
- **D** *Timed discharges, as needed, through built-in piping systems ... supplied instantly from a single storage unit holding tons of liquid Cardox CO_2.*

CARDOX CORPORATION • Bell Building, Chicago, Illinois

District Offices in New York • Detroit • Pittsburgh • Cleveland • Kansas City San Francisco • Los Angeles

CARDOX

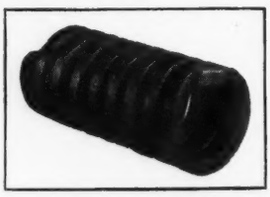
NON-DAMAGING FIRE EXTINGUISHING SYSTEMS

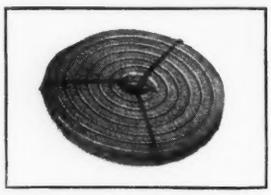
TAME THOSE LINES with R/M PACKINGS

Under the higher pressures and increased temperatures demanded by all-out production, steam lines, oil lines, air lines, and fuel lines put packings to the test. And R/M packings are meeting these higher pressures, these increased temperatures. Taming the lines, so to speak.

With practical knowledge of the new demands made upon packings, our laboratories are drawing upon their engineering ingenuity to make R/M packings better and better. Out of the welter of war-time necessity will come product-improvements that peace-time use might never have inspired.

Do you have a copy of the R/M catalog? It's keyed for applications, illustrated, and indexed as to materials and types. Get a copy of this catalog from your R/M distributor, or write us direct.





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RAYBESTOS-MANHATTAN, INC.
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Makers of Packings for Every Industrial Use

Pennsylvania; Alleghany in Maryland; Mineral, Grand and Pendleton in West Virginia; Highland, Bath, Alleghany, Craig, Giles, Pulaski, Wythe and Grayson in Virginia; Ashe, Watauga, Avery, Mitchell, Yancey, Madison, Haywood, Swain, Graham and Cherokee in N. Carolina; Fannin, Murray, Whitfield, Catoosa, Dade, Walker, Chattooga, Floyd, Polk, Haralson, Carroll, Heard, Troup, Harris, Muscogee, Chattahoochee, Stewart, Quitman, Clay, Early, Seminole and Decatur in Georgia and Gadsden, Liberty and that part of Franklin which lies east of the Appalachicola River in Florida.

(b) States of Oregon and Washington.

Area Two

(c) States of Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee and Wisconsin.

Area Three

(d) All of the States of Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, West Virginia and the District of Columbia.

(e) States of Oregon and Washington.

For precise definitions, limitations, exceptions and procedures, all users within these areas should write to the Office of Petroleum Coordinator, Department of the Interior, Washington, D. C., Ref: L-56, for a copy of this limitation order, but the following summary will give a general idea of what is required.

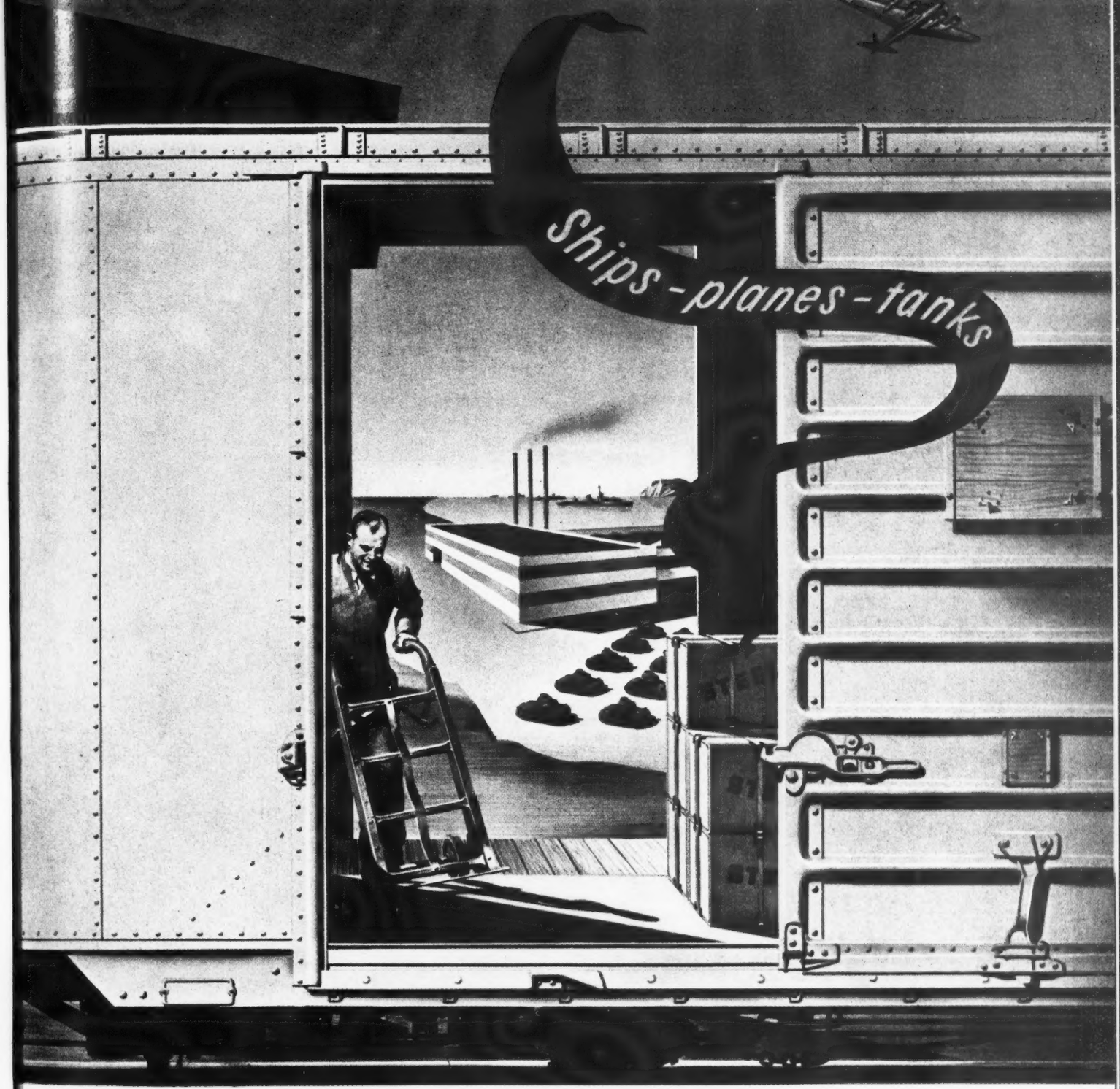
The order does not apply to the delivery of oil for use in internal combustion engines.

One limitation applies to the entire United States. It is now unlawful everywhere to deliver fuel oil for use in coal spraying.

Within *Area One* monthly deliveries to any user for space heating and central heating and cooling equipment, also for domestic and commercial water heating equipment, are limited to 50% of the use for the corresponding month of 1941 (with corrections for special cases).

Within *Areas One, Two and Three* deliveries of fuel oil to operate additional facilities or facilities from other fuel to fuel oil, are forbidden. (See order for exceptions).

Within *Areas One, Two and Three* fuel oil may not be delivered to an



Even before they're made they must travel

American planes could never hope to dominate the skies . . . American tanks could never crash their way to victory . . . American ships could never hope to succor a desperate world . . . if American *transportation* had not first done the biggest job of its kind in history.

At a time when *everything* depends upon a free flow of traffic, the American transportation system has worked so magnificently that America, like a man with a good stomach, has scarcely been aware of its existence.

Even before ships, planes, tanks and guns are made, the railroads and other means of transportation must carry the raw materials thousands of miles from a thousand suppliers to a thousand different parts of the nation.

Koppers has been able to furnish supplies of basic materials needed by the transportation industries . . . from Koppers coal mines, from Koppers plants where ties and other wood products are pressure-treated to give them long life, from Koppers creosote refineries, from Koppers roofing and waterproofing plants, and paint factories . . . from plants which make packing for steam locomotives and piston rings for Diesels.

Maybe, some day in the future, these products may serve your peacetime operations as they are now serving wartime safety. Koppers Co., Pittsburgh, Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

BUY UNITED STATES WAR BONDS AND STAMPS

JUNK

—you've got what it takes

THAT old junk -- useless to you -- may provide the extra implements of war to insure Victory -- your old iron and steel, copper, brass, rubber, even burlap, paper and grease.

Take steel, for example. Every hundred pounds of scrap you turn in will help produce one more powerful demolition bomb to speed the destruction of those plants that enable the Nazis and Japs to prolong the war.

To make the steel for a large tank, 10 to 15 tons of scrap are needed. And one badly needed "sub-chaser" takes many carloads of scrap.

The steel industry is using all its resources to produce more steel, but it needs your help and needs it now, -- that's why the junk you can turn in is so vital to America's war effort.

THE YOUNGSTOWN SHEET & TUBE COMPANY

Youngstown, Ohio

★ ★ ★ ★ ★ ★

"WASTE NOT — YOUNGSTOWN — WANT NOT"

Looking ahead with Asbestos

Wouldn't you predict a glowing future for a building material that, while lending itself readily to modern design, costs nothing to maintain?

Even before the war put a premium on quick erection-time, K&M Asbestos Corrugated and Flat Lumbers were the favored building materials in many progressive plants. Low first cost aside, it is a downright pleasure to efficiency-minded men to own a building that won't rot or rust, never needs painting and is not affected by weather.

Urgent wartime construction has been drafting most of this remarkable building material that K&M can make. But when peace comes it will certainly resume its deservedly popular peacetime role. Meanwhile, our research laboratories are continuing to explore the service possibilities of Nature's strangest mineral; we would be glad to study any problem of yours that might lead to greater asbestos usefulness.

* * *

Nature made asbestos;
Keasbey & Mattison, America's asbestos pioneer,
has made it serve mankind . . . since 1873.

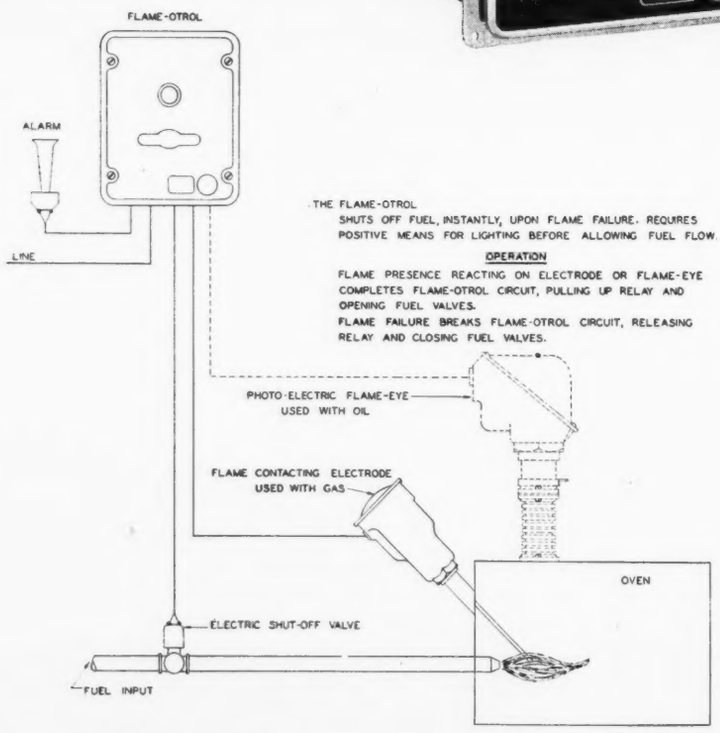
KEASBEY & MATTISON
COMPANY, AMBLER, PENNSYLVANIA

Makers of

asbestos-cement shingles and wallboards; asbestos and magnesia insulations for pipes, boilers, furnaces; asbestos textiles; asbestos electrical materials; asbestos paper and millboard; asbestos marine insulations; asbestos acoustical material; asbestos packings; asbestos corrugated sheathing and flat lumbers; asbestos-cement pipe for water mains.

YOU CAN PREVENT COMBUSTION EXPLOSIONS

regardless of fuel burned


FLAME-OTROL
ALARM
LINE
THE FLAME-OTROL
SHUTS OFF FUEL, INSTANTLY, UPON FLAME FAILURE. REQUIRES POSITIVE MEANS FOR LIGHTING BEFORE ALLOWING FUEL FLOW.
OPERATION
FLAME PRESENCE REACTING ON ELECTRODE OR FLAME-EYE COMPLETES FLAME-OTROL CIRCUIT, PULLING UP RELAY AND OPENING FUEL VALVES.
FLAME FAILURE BREAKS FLAME-OTROL CIRCUIT, RELEASING RELAY AND CLOSING FUEL VALVES.
PHOTO-ELECTRIC FLAME-EYE USED WITH OIL
FLAME CONTACTING ELECTRODE USED WITH GAS
OVEN
ELECTRIC SHUT-OFF VALVE
FUEL INPUT

The Wheelco FLAME-OTROL

—provides instantaneous shut-off of fuel supply in case of flame failure. It is the only combustion safeguard approved by both the Underwriters' Laboratories and the Associated Factory Mutual Laboratories for all types of fuel. The FLAME-OTROL is available with automatic or manual ignition, time delay for purging, or any other sequence of operation desired.

Bulletin L2 gives complete information. Request your FREE copy TODAY!

Wheelco Instruments Co.
863 HARRISON STREET • • • CHICAGO, ILLINOIS

operator who has standby facilities (using other fuels than fuel oil, electricity or natural gas) until such facilities are being operated to the maximum extent to reduce the requirement for fuel oil.

A representative of the Director of Industry Operations or of the Office of the Petroleum Coordinator for War is empowered to investigate installations to determine whether fuel burning equipment should be converted to the use of some fuel other than fuel oil, electricity, natural gas, or mixed natural and manufactured gas.

Buyers of Heavy Equipment Must Rate A-9 or Better

By a War Production Board order first issued May 18 and amended on June 8, the manufacture, delivery and sale of "heavy power and steam equipment" has been restricted to orders for defense agencies, United Nations, Lend Lease, and orders (other than repair and maintenance) rated A-9 or higher. New heavy power and steam equipment may be manufactured, sold and delivered only on an "approved order".

Approved orders are limited to the following: (1) One accompanied by PD-3A certificate and for account of Army, Navy, Maritime Commission (and other government agencies listed) or for the nations with which we have lend-lease or similar arrangements; (2) an order bearing a preference rating of A9 or higher assigned by Preference Rating Certificates PD-2, PD-3, PD-3A, PD-4, PD-5 or Preference Ratings Orders P-19, P-19a, P-19b or P-5b, issued prior to May 18, 1942, or by Preference Rating Certificates PD-1, PD-1A or PD-25a or Preference Rating Orders P-19h (Pd--200 or 200A), or a specific rating assigned by the Director of Industry Operations for repair and maintenance issued at any time.

The Order defines "heavy steam and power equipment" as follows:
(1) Steam boilers above 100 psi: Following equipment serving such boilers; stokers, pulverizers, feed pumps, fuel conveyors, draft fans, dust collectors, valves (above 600 psi and 750 F). (2) Steam-turbine and steam-engine generator units. (3) Mechanical-drive steam turbines above 50 hp. (4) Condensers (steam), heat exchangers for use in steam-electric generation, auxiliaries. (5) Hydro-turbine generator units. (6) Internal-combustion engine and engine generator parts above 50 hp or 25 kw if connected to gener-

Sailor—

WE EARNED THE NAVY "E"

Our pledge to the Navy

To the United States Navy and to the Nation, we of American Blower pledge the unstinted devotion of our experience, our ability, our effort. Whether destined for use on the battle lines, or to equip other essential industries for production of vital material — the products of our efforts, we pledge, will continue to measure up to the standard of excellence that is worthy of the commendation, "Well Done." We are proud of the privilege of working under the Navy "E" burgee — proud to wear the insignia conferred on us. By our progress in production, we shall continue to demonstrate our patriotism and determination to win. We are mindful of our responsibilities. We are working, and shall continue to work, for Victory!

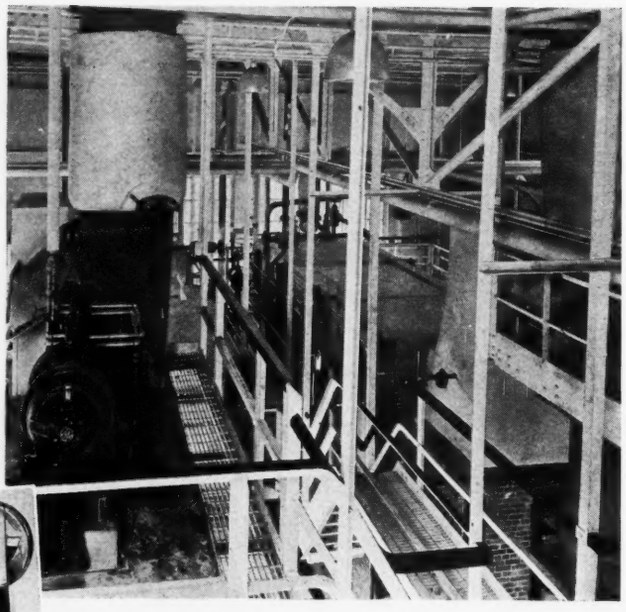
MECH. DRAFT · AIR-CONDITIONING
AMERICAN BLOWER
FLUID DRIVES · DUST COLLECTORS

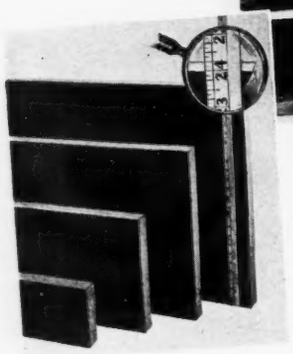
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of AMERICAN Radiator and "Standard" Sanitary Corporation

BALDWIN-HILL INSULATIONS

Used on all DUCTS and BREECHINGS of the recently constructed GLENN L. MARTIN BOMBER PLANT





BALDWIN-HILL MONO-BLOCK

Effective over the full range of temperatures up to 1600° F.

Speed—more speed needed to produce swarms of bombers—and B-H MONO-BLOCK does its bit by eliminating lag in bringing heating equipment to operating temperatures; by maintaining uniform temperatures; and facilitating closer control of temperatures.

B-H MONO-BLOCK, made of 100% chemically stable rockwool fibres felted under a patented process, withstands severe heat and moisture conditions. It forms a strong, lightweight block which is easily cut and fitted to equipment having irregular as well as flat surfaces. Standard sizes: 6", 12", 18" and 24" wide; 18" and 36" long; ½" to 4" thick.

BALDWIN-HILL CO., 575 Klagg Ave., Trenton, N. J.

NEW YORK • DETROIT • KALAMAZOO, MICH.

Send for Catalog showing full line

B-H Black Rockwool BLANKET . . . B-H MONO-BLOCK
B-H No. 100 PIPE COVERING . . . B-H MINERAL FELT
B-H No. 1 INSULATING CEMENT . . B-H WEATHERSEAL
and other heat insulations effective up to 2000° F.

190 (531c)

ators. (7) Frequency changers. (8) Synchronous condensers, (9) Mercury-arc rectifiers for power use. (10) Oil or air circuit breakers of 600 amperes or larger or 16,000 volts or higher rating. (11) Metalclad switchgear. (12) Unit substations. (13) Transformers above 500 kw.

Invent For Victory

According to a poster received from the Department of Commerce, Washington, D. C., all Americans who have an invention or idea which might be useful to their country are urged to send it immediately to

National Inventors Council
Department of Commerce
Washington, D. C.

Westinghouse Elects Four New Vice Presidents

Election of four Westinghouse executives to the rank of vice president is announced by G H Bucher, president of the Westinghouse Electric and Manufacturing Company following action by the Board of Directors.

They are Andrew H Phelps of Pittsburgh, Pa., manager of purchases and traffic; L E Osborne of Philadelphia, Pa., manager of the steam division; Frank C Reed, of Jersey City, N. J., president of the Westinghouse Electric Elevator Company, a subsidiary; and Walter C Evans of Baltimore, Md., general manager of radio, x-ray and broadcasting divisions. All the new vice presidents will continue in their present executive posts.

Andrew H Phelps, general manager of purchases and traffic, joined Westinghouse on January 1, 1937, coming from

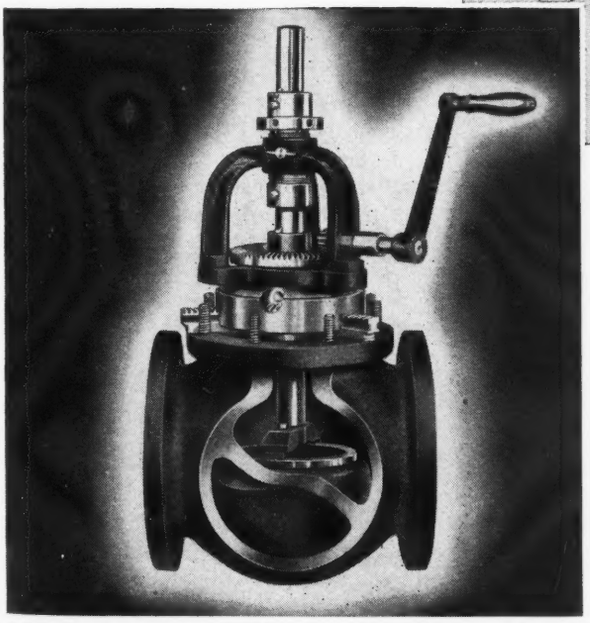
Fabian Bachrach Photo

the McGraw-Hill Publishing Company where, for seven years, he served as sales manager and director of public relations.

Mr Phelps was born at Steele City,

FIX Leaky Valves NOW

No Waiting for Parts—



In less than an hour's time, any mechanic using a Dexter Valve Reseating Machine can make a valve seat and disc or gate absolutely tight.

No need to remove the valve from the line, no unnecessary delay, no waiting for parts. Dexter equipment will reseat monel, stainless steel, and stellite, as well as brass and bronze seats.

Put an end to leaky valves that waste steam, air or water that may cause a shutdown while you wait for parts. Order a Dexter Valve Reseating Machine today.

Capacities: Globe valves, ¼" to 14"; Gate valves, 1½" to 48"; Pump valves, 1½" to 15".

LEAVITT MACHINE TOOL CO., 506 EAST RIVER STREET, ORANGE, MASSACHUSETTS

DEXTER

Valve Reseating Machines

Waters from China traveled 6,000 Miles to SUHM laboratory for Scientific Analysis...

Power and Production Engineers from China, South Africa, South America, Europe, and the United States know the SUHM reputation for SCIENTIFIC WATER TREATMENT.

For over forty years, water samples, water problems from power and processing plants all over the world have passed through the SUHM Laboratories . . . Have been analyzed, studied, corrected with a sureness and effectiveness that only a long lifetime of experience can achieve.

A Water problem from China—or from Oskaloosa, U.S.A.—have little in common. Each is INDIVIDUAL and must be treated as an individual problem. So it is with YOUR Water . . . It's probably far different even from the plant around the corner. There's no "standardized" solution, no trademarked specialty, that can offer a profitable solution. Give that problem to SUHM CHEMISTS trained in finding an INDIVIDUALIZED treatment for ANY Water, and you may be assured of profitable correction that will be definitely felt in lower fuel costs, better power or production efficiency.

Protect YOUR Wartime Power and Production Costs NOW. Return the coupon for a shipping jug and container, and a FREE analysis of your water and a recommended formula of treatment.

SUHM

Individualized WATER TREATMENTS

for POWER and PROCESSING

and *SPECIALIZED* CLEANING PROBLEMS

★ DEPENDABLY SOLVING INDUSTRIAL POWER ★ PROBLEMS FOR OVER 40 YEARS . . .

★ Some Territories still open for Mgrs. agents who can qualify.

SUHM COMPANY, Inc.

1942-50 S. Kinnickinnic Ave., Milwaukee, Wisconsin

Please send me a jug and shipping container in which to return a sample of our Raw Water for Analysis and recommendations—without obligation.

Name .....

Address .....

Neb. He attended the Georgia Southern Military College at Bainbridge, Ga., and was a student of accounting and law at the Brooklyn Institute of Accountancy.

L E Osborne, manager of the Westinghouse steam division with head quarters in the South Philadelphia works, was born near Verona, Pa., near Pittsburgh. He went to work for Westing-

Blackstone Studios

house as a tool clerk in the East Pittsburgh works in 1910, earning 16 cents an hour. In 1915, he was given the task of training new men as tool makers. After various promotions, Mr Osborne was appointed superintendent of the metal stamping department in 1930. In 1941, Mr Osborne spent several months as chief of the heavy ordnance section in the Ordnance Branch of the Production Division of OPM in Washington. He became manage of the steam division in November, 1941.

Frank C Reed has been president of the Westinghouse Electric Elevator Company since 1936. He was responsible for many of the large elevator intallations throughout the country, one of the most important being 120 Westinghouse elevators installed in Rockefeller Center in New York City. In September, 1941, his Company was awarded the Navy "E" for excellence in production of war material.

Walter C Evans, general manager of radio, x-ray, and broadcasting division, is a native of Columbus, Ohio. He joined Westinghouse in 1921, as radio operator in a broadcasting station built by the company in Chicago. The following year he was put in charge of technical operations and in 1926 was made station manager. Since 1936 he has headed the company's broadcasting activities.

Industrial Inspection Firms Rated A-10 for Supplies

Firms engaged in examining or inspecting industrial installations for the purpose of discovering faults or defects

GETTING THE *MOST* FROM YOUR THERMAL INSULATIONS...

NUMBER 4 in a series of messages to American industry devoted to conserving heat, improving operation and increasing production through modern insulation practice.

PROPER APPLICATION IS IMPORTANT...

Canvas, paints and the ability of the painter are the raw materials which enter into the making of a painting. The degree of knowledge and skill possessed by the artist determines largely whether the finished picture will be a valueless daub or a priceless masterpiece. Similarly, even the best of thermal insulating materials will fail to fulfill their functions if they are not properly applied. Selection of an efficient time-tested material, such as Ehret's 85% Magnesia, is of primary importance. And the skill with which Ehret approved contractors apply coverings and blocks to piping, boilers and equipment is equally vital to overall insulating efficiency.

★ EHRET'S 85% MAGNESIA and many other Ehret heat insulating materials are fully treated, both as to selection and application, in the new 176-page Heat Insulation Handbook. It will be furnished, without obligation, to those interested in getting the most from their thermal insulations. Write today for your copy of Handbook A 207.

EHRET MAGNESIA MANUFACTURING CO.
VALLEY FORGE, PENNA.

...THERE IS AN *EHRET* DISTRIBUTOR OR CONTRACTOR IN EVERY INDUSTRIAL AREA

SPECIFY MAXIM

. . . FOR BETTER WORKING CONDITIONS

Today every factor that can increase production is doubly important because *this time* our very national existence depends upon our collective success in turning out materials of war faster.

Maxim Silencers, quieting internal combustion engine exhaust or intake, compressor intake, steam blow-off, certainly improve working conditions . . . and less distraction from constant racket means less "noise fatigue", less production "slow-ups".

One of the great advantages of Maxims is their simple yet durable design and construction insuring long service life with minimum maintenance. Also, should your problem include a hazardous condition where sparks from an exhaust might be dangerous, we can supply silencers with the spark arrestor feature included.

The Maxim Silencer Co.

92 Homestead Ave., Hartford, Conn.

MAXIM SILENCERS

are authorized to use an A-10 preference rating to obtain operating supplies by Amendment No. 1 to Preference Rating Order P-100. The amendment was issued February 28 by the Director of Industry Operations.

The functions of companies engaged in the inspection of boilers and other plant equipment is closely related to maintenance and repair, and the amendment gives such firms the benefit of the same priority rating which might be used by the companies for which they perform inspections. Their chief need is for certain small precision tools used in such work.

Pitch Will Extinguish Magnesium Fires

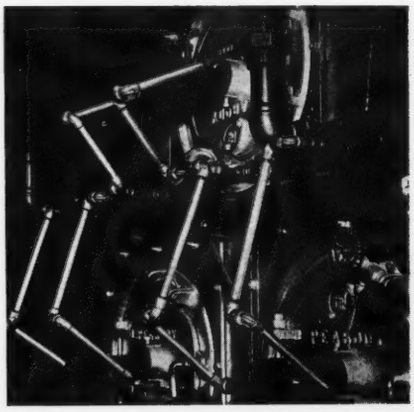
In a circular letter of the U. S. Bureau of Mines, Pittsburgh, Pa., dated April 30, H R Brown, I Hartmann and H P Greenwald, of the staff of the Central Experiment Station, report the results of tests made to determine the best ways to extinguish magnesium fires.

For fires in magnesium chips, etc, occurring in factories, they recommend the use of coal-tar pitch of the "very hard" variety, with a softening point not much less than 300 F. For best results use lump pitch ground until not less than 98% will pass a U. S. No. 6 sieve and 90% or more will be retained by a U. S. No. 40 sieve. Flakes pitch may be used without crushing provided (1) few if any flakes have an area greater than 1 sq in., (2) the flakes are not thicker than ⅛ in. and (3) 90% or more of the pitch will be retained by a No. 40 U. S. sieve.

To extinguish a magnesium fire on metal or dry concrete surfaces or on dry ground, spread a layer of pitch over the burning metal with a long-handle scraper or shovel. The pitch will soften and seal the fire. If, after the first application the pitch tends to burn with a short flame, this can be stopped by applying a second thin layer of pitch over the flaming parts.

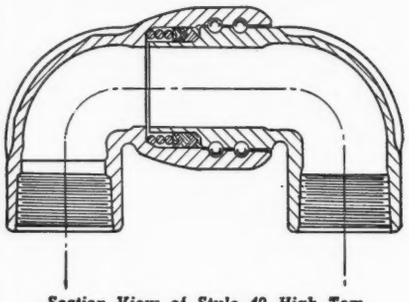
After the fire is extinguished, the mass should be allowed to cool for a reasonable time (5 to 10 minutes is enough for small fires) after which the pitch covering can be removed from the magnesium. If pitch is applied properly after the fire is discovered, most of the magnesium will be recovered before it is consumed. If the pitch is allowed to cool until it is quite hard, it should be chipped off the underlying metal or other surface; on machine beds, bronze or other soft tools should be used for this purpose.

To extinguish magnesium fires on



CHIKSAN JOINTS
for FLEXIBLE FUEL LINES

Illustration above shows a typical installation of CHIKSAN Ball-Bearing Swing Joints to give required flexibility in fuel lines to the burners in a modern boiler room. Just another example of how CHIKSAN is aiding in the conservation of rubber. How can we help you?



Section View of Style 40 High Temperature (Steam Type) Joint for temperatures to 700° F, pressures to 500 lbs.

NOTHING TO TIGHTEN OR ADJUST

CHIKSAN Swing Joints turn on double rows of steel balls which carry all radial and thrust loads and maintain alignment of moving parts. Full 360° rotation in 1, 2 and 3 planes.

FOR SUCTION, PRESSURE OR VACUUM LINES

Over 500 different types, styles and sizes for working pressures to 300 lbs. and 3,000 lbs. and temperatures to 700° F. Special Packing Unit in High Temperature Joints is impervious to chemicals injurious to rubber or synthetic compounds.

Write for Latest Chiksan Catalog

REPRESENTATIVES IN PRINCIPAL CITIES
DISTRIBUTED NATIONALLY BY CRANE CO.

CHIKSAN TOOL COMPANY
BALL BEARING SWING JOINTS for ALL PURPOSES
BREA, CALIFORNIA

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS

ARE MAKING THESE *Vital* CONTRIBUTIONS

1 Keeping Fuel Consumption Low
2 Boosting Boiler Output
3 Cutting Boiler Attention Needs

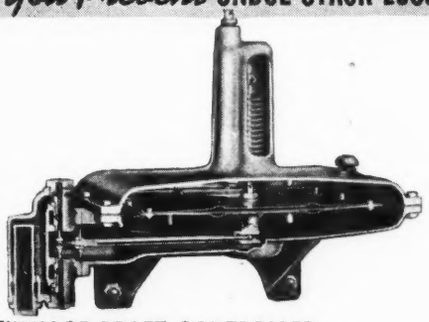
CORRECT FUEL FEED
You Save **COAL, OIL OR GAS**
PROPER AIR SUPPLY
YOU BURN FUEL *Economically*
CONSTANT OVER-FIRE DRAFT
You Prevent **UNDUE STACK LOSS**

CASH STANDARD control instruments meter the fuel supply, whether coal, oil, or gas, so that at every instant the need of that instant is balanced. There is never over-firing to cause waste of fuel or under-firing to cut steam supply and slow up production.

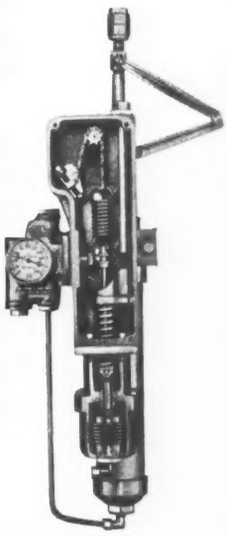
Realizing proper combustion is another important result from this modern automatic control. The air supply is continually adjusted as required so that a correct proportion of carbon from the fuel and oxygen from the air is maintained.

Through proper operation of the stack damper as afforded by CASH STANDARD controls, the heat produced goes into the boiler water instead of out the stack.

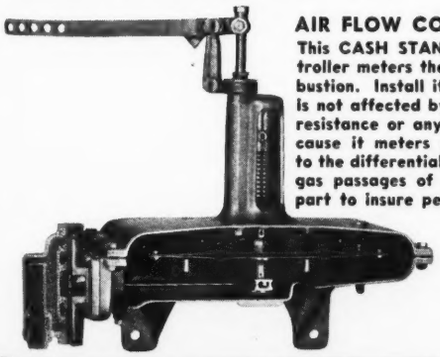
Both largest plants and those as small as 75 boiler h. p. are getting steam plant economy through CASH STANDARD units which make up the systems. These units are available in a number of variations so that all types of plants can be successfully equipped.



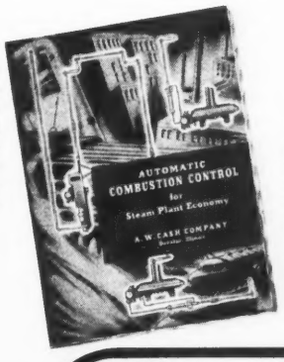
FURNACE DRAFT CONTROLLER
This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.



FUEL FEED CONTROLLER
This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion — hence, money saving.



AIR FLOW CONTROLLER
This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



Bulletin No. 300 gives full details on Automatic Combustion Control for steam plant economy and shows applications of these systems for those who burn coal, oil or gas.

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . . VALVES

PRECIOUS FUEL GOING UP IN SMOKE ?

Cut waste sharply with Ranarex*

CO_2 INDICATOR and RECORDER

Watch CO_2, as recorded by Ranarex, and you reduce heat loss in the flue gases. This tough instrument is all mechanical—no chemicals or fragile parts to break down under 3-shift strain. Yet it gives accurate readings—instantly!

FREE BOOKLET from The Permutit Company, Dept. A, 330 West 42nd Street, New York, N. Y. In Canada: Permutit Company of Canada, Ltd. . . Montreal . . Toronto . . Winnipeg . . Calgary.
*Trademark Reg. U. S. Pat. Off.

product of

PERMUTIT

wood floors (or on wet ground), apply a small quantity of pitch over the fire to reduce the heat and glare. Then spread a layer of pitch approximately 1 in. thick on the floor alongside the fire and carefully transfer the burning mass onto the pitch layer with a shovel or hoe. Finally cover the entire surface of the fire with more pitch and also scrape away any burning particles or embers from the floor. Finally, apply water to the burning wood to prevent the spread of the wood fire.

Pitch is not recommended for domestic use in extinguishing incendiary bombs. Water spray is preferred there.

The circular letter lists companies that are prepared to supply pitch of suitable specification for this work.

OBITUARIES

A E Crockett, 69, special sales representative for the Jones & Laughlin Steel Corp, died recently after a short illness. Mr Crockett had been associated with Jones & Laughlin since May 1915, when he joined the organization as an engineer. In 1919 he was appointed manager of the Bureau of Instruction and later was made special sales representative. He devoted himself primarily to educational work, lecturing at colleges and before engineering and technical societies on the manufacture of iron and steel products.

George W Stetson, 65, president of the Stets Co, Boston, Mass., inventor of a regulator bearing his name and deviser of other power plant equipment, died at Hingham, Mass., on May 20.

William B Willson, of East St Louis, Ill, for over 28 years Western sales manager of the Roto Co, Newark, N. J., died suddenly on May 8 at the age of 64. He was well known among refinery and power plant engineers.

Archille F Arsenault, 68, for 18 years an engineer on the staff of the Gillette Safety Razor Co, Boston, Mass, died at Arlington, Mass, May 28. He was born in Magdalene Island, Canada, and before his Gillette connection was an operating engineer for Keith's Theatre, Boston.

Ralph W Eaton, 62, public service engineer of the city of Providence, R I, since 1918, and a national authority on safety engineering, died suddenly at Bristol Highlands, R I on June 1. He was born at Hill, N H, and was graduated from the Massachusetts Institute of Technology in 1903. After some

Have You Tried FRANCE Metal Packing?

The France Representatives listed below are packing experts. They are experienced in the solution of engine, pump and compressor packing problems that have to do with pressure, temperature, friction and lubrication. They are good men to know well. Tear out this list or at least the number nearest you. Keep it handy. Use it to your advantage.

France Metal Packing Representatives:

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PHILADELPHIA, PA
Tacony MAYfair 1024

SAN FRANCISCO
Hercules Equip. 550 Third St. EXbrook 2575

LOS ANGELES
A. C. Elder, 2714 So. Hill St. PRospect 9529

NEW ORLEANS
R. M. Shad, 7738 Hampson St. WAL 4786

CHICAGO
J. H. McKenna, 1346 Washington Blvd. HAYmarket 6621

SEATTLE
W. H. Rober, 24 W. Connecticut St. ELlott 6644

MID-CONTINENT
N. M. Fuller, 2603 Azle Ave., Fort Worth, Texas Fort Worth 7-1733

NORFOLK
C. E. Thurston & Sons, 56 Commercial Place NORfolk 2-6040

BOSTON
Owen S. Williams, 26 Grenville Road, Watertown, Mass. Watertown 3974

Request France Engineers to analyze your packing requirements.

THE FRANCE PACKING COMPANY
Tacony, Philadelphia, Penna.

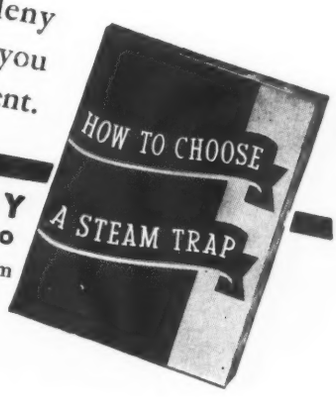
Original FRANCE METAL PACKING

HOW to choose a STEAM TRAP

CAN YOU tell quickly what size steam trap you need on that autoclave, steam main, or header drip? Are you sure what style of trap should be used to get all the air instantly out of that steam kettle or steam chest?

These questions are simplified for holders of the book illustrated below. This free book tells what a steam trap must do . . . how it does its job . . . why air elimination is important . . . how to figure condensation rates . . . gives frequently used condensation rate tables . . . etc.

Send for this useful book today—don't deny yourself its help. Fill out the coupon before you forget—and the book doesn't cost you a cent.



THE V. D. ANDERSON COMPANY
1934 WEST 96th STREET • • CLEVELAND, OHIO

Gentlemen: Please send me my copy of "How To Choose A Steam Trap." I understand this does not obligate me in any way.

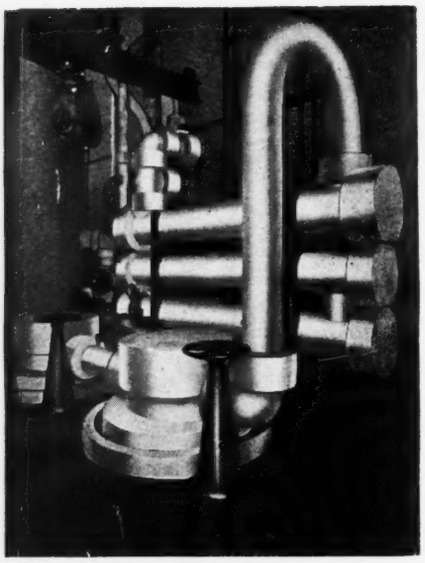
Name.....

Company.....

Address.....

City.....

State.....



Hold that PRODUCTION with HENSZEY CONTINUOUS BLOWDOWN!

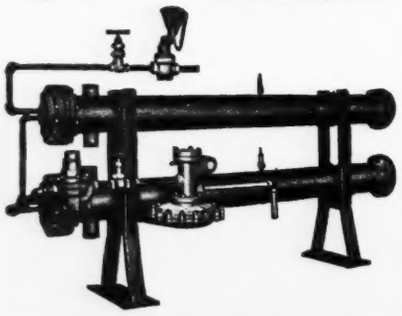
To *attain* peak production requires plenty of concentrated effort but to *maintain* peak production is the real job before us now. Boiler shutdowns, equipment breakdowns, and other delays along the "power line" can be minimized with Henszey Continuous Blowdown. This system in operation enables your boilers to produce at maximum capacity for long periods of time. They can produce the great volume of clean steam needed for war production.

The Henszey system continuously and automatically draws off the trouble making impurities of the boiler water —keeping them well below a predetermined "safe point". Priming, foaming, carryover and (with simple chemical treatment) scale are prevented.

Write for our folder "Complete Automatic Control of Boiler Water Concentration". A copy is yours for the asking.

HENSZEY COMPANY

Dept. D 7 Watertown, Wis.



HENSZEY

years with the Westinghouse Co he was active in the transit field in Connecticut until his Providence appointment. He was the vice president of the Providence Engineering Society and was well known in the leading branches of the engineering profession of the northeast.

ERVIN KENISON, 75, former professor of mechanical engineering at the Massachusetts Institute of Technology, died at Huntington, W Va, on May 12. He was born at Charlestown, Mass, and after being graduated from the Institute in 1893 became an instructor there, retiring in 1935.

CARY D WATERS, president of the C J Tagliabue Mfg Co, Brooklyn, N Y, passed away May 9, 1942.

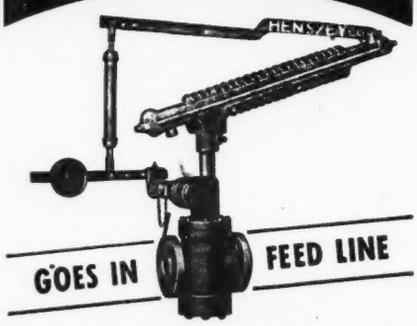
L A S WOOD, one of the outstanding illuminating engineers in the country, died May 6 after a brief illness. He was chief lighting engineer of the Westinghouse Electric & Mfg Co in Cleveland, Ohio. He had been associated with the lighting industry ever since he began his career. He was born in London and received his education at the City of London School of the University of London. Afterwards he studied electrical engineering under Prof P Thomson at Finsbury Technical College. When the Cutter Co was absorbed by the Westinghouse Electric & Mfg Co, Mr Wood was made manager of the company's street lighting department with headquarters at South Bend, Ind. Mr Wood served as consultant on lighting for the recent Chicago Exposition and the great Lakes Exposition at Cleveland, Ohio. At the time of his election to the presidency of IES in 1935 he was made chief lighting engineer of the lighting division and transferred to the New York office of the Westinghouse Electric & Mfg Co. In Oct 1936 he returned to the Cleveland works in that capacity.

PERSONALS

JOHN S JENKINS, JR, has been elected a member of the board of directors of the Virginia Electric & Power Co, to succeed the late George H Lewis.

WILLIAM H BROWNE has been named a research engineer on the technical staff of the Battelle Memorial Institute, Columbus, Ohio, where he has been assigned to the division of fuel research. Mr Browne, a graduate in mechanical engineering of Rensselaer Polytechnic Institute, was associated with the Caterpillar Tractor Co, Peoria, Ill, prior to joining the Battelle staff.

HENSZEY
BOILER FEED REGULATORS



The Henszey Boiler Feed Regulator controls boiler water levels continuously and accurately under *all* load conditions!

These simple, compact, self-contained units go right in the feed line and require no additional structural support. They are as easy to install as a simple gate or globe valve. Once installed and set for operation no further attention is necessary—nothing to get out of order—nothing to reset.

Send for latest Bulletin containing full details.

HENSZEY COMPANY

Dept. D7—Watertown, Wis.

SAUERMAN

POWER SCRAPER
For BETTER COAL STORAGE
The problem of storing coal safely and economically has been solved permanently at hundreds of steam generating plants both large and small by installing Sauerman Power Drag Scrapers.
This system of handing coal has no equal for simplicity of installation and operation, nor does any other method carry as positive an assurance as the Sauerman system of building a coal-pile that will be free from the chance of spontaneous combustion.
Write for Catalog
SAUERMAN BROS. INC.
562 S. Clinton St., Chicago, Ill.

NOW... PLASTIC INSULATION CAN PROTECT EQUIPMENT FROM RUST, CORROSION!

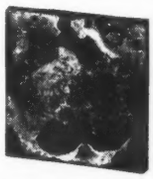
In two important ways, Eagle Super "66" is aiding America's War Effort

First... Eagle Super "66" is a patented rust-inhibitive plastic insulation. It conserves metals by protecting equipment to which it is applied from rust and corrosion.

Second... Eagle Super "66" conserves fuel in tremendous quantities because it is so outstandingly efficient. Its springy ball structure assures positive heat control for temperatures as high as 1800° F. And since the basic insulating material (mineral wool) in Eagle Super "66" is both chemically and physically stable, since it does not disintegrate during service, full effectiveness is maintained from year to year.

Application of Eagle Super "66" is quick, easy, economical. Dry coverage is 50-55 sq. ft. 1-in. thick per 100 lbs. 100% reclaimable when used at temperatures to 1200° F. Write today for new catalog sheets which give technical data on efficiency and application.

Steel Plate Tests Demonstrate Rust-Inhibitive Properties



Ordinary plastic insulation was applied to a flat polished steel plate and subjected to room temperatures for several weeks. Note how surface of plate became rusted and pitted.

Eagle Super "66" was applied (wet) to an identical steel plate. Same conditions prevailed. Note complete absence of rust and corrosion when layer of Eagle Super "66" was removed!

Important: To protect insulation, coat with Eagle Insulseal. This durable, fire-proof coating protects all kinds of heat insulation from disintegration and loss of insulating value. Safeguards against air infiltration, moisture, water, fumes—against vibration and abrasion.

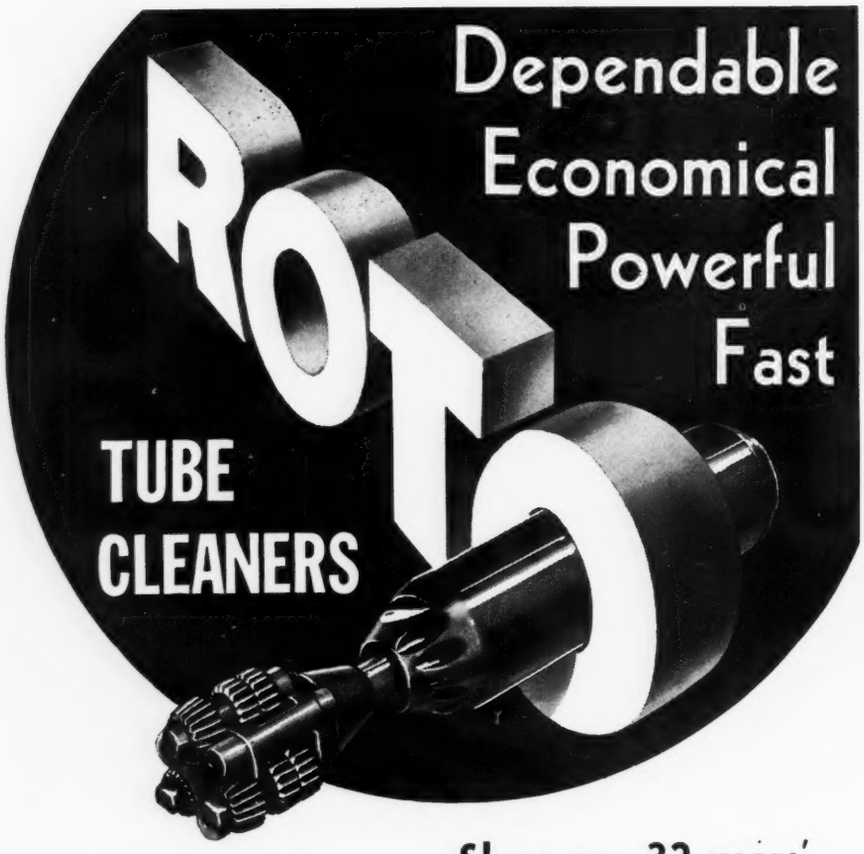
Eagle-Picher High Temperature Insulations

Eagle Super "66" Plastic Insulation
Eagle Supertemp Blocks
Eagle L-T Felts
Eagle Blankets

EAGLE EP PICHER

Eagle Finishing Cements
Eagle Loose Wool
Eagle Insulseal
Eagle Insul-stic

THE EAGLE-PICHER LEAD COMPANY · CINCINNATI, OHIO



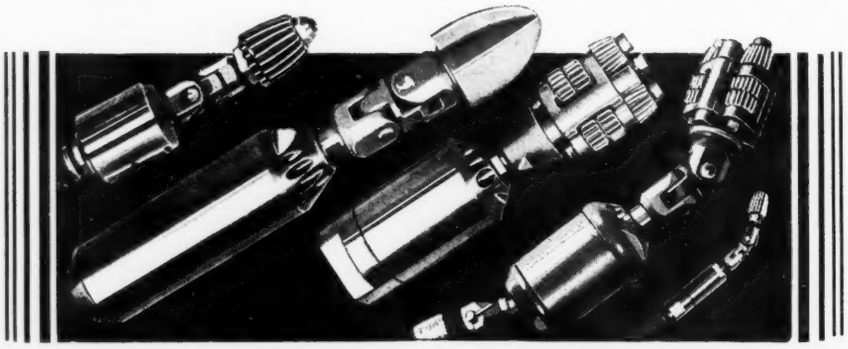
SEE OUR ADV. IN SWEET'S

The ROTO Company

145 SUSSEX AVENUE

NEWARK, N. J.

Share our 32 years' experience as tube cleaner specialists by letting us serve you.



BETTER SERVICE — SAFETY — SATISFACTION

FOR REPLACEMENTS ORDER

PRECISION GAGE GLASSES and GAGE GLASS GASKETS THAT WILL NOT BLOW OUT

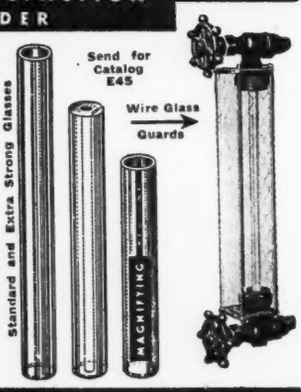
Standard Square Cut Gaskets High Pressure Non-hardening and Non-softening

GASKETS THAT WILL FIT EXACTLY

Red Lip-mold Pattern Expansion Type Gasket

Send for Glass and Gasket Chart

Shipment made by parcel post the same day as order is received



ERNST WATER COLUMN & GAGE CO.

RUBBER & GLASS DIVISION LIVINGSTON, NEW JERSEY

FREDERIC N BUSHNELL, vice chairman of the board, Stone & Webster Engineering Corp, Boston, received a 50-year ASME membership pin on May 21 at a meeting in Cambridge, Mass. President James W Parker of that organization made the presentation. In the citation tribute was paid to Mr Bushnell's early experience in building reciprocating engines in Providence, R I, his term as operating and chief engineer of the Narragansett and Rhode Island companies, and his constructive influence as chief engineer and later engineering manager of the Stone & Webster organization.

WILLIAM C JOHNSON, sales manager of the crushing and cement division of the Allis-Chalmers Mfg Co, Milwaukee, Wis, has been named manager of the general sales organization of the company. As general sales manager Mr Johnson will direct the sale of 1600 different products and the operations of 60 district offices.

EUGENE K INGALLS has been appointed to the sales department of Thomas G Wilson, Inc, Long Island City, N Y. "Gene" Ingalls is well known to users of tube cleaning equipment. He is a graduate of the University, Class of 1923, and is a member of the National Association of Power Engineers.

J C WAYNE has been appointed advertising and sales promotion manager of the Hotstream Heater Co, Cleveland, Ohio. Mr Wayne succeeds O A Reiter, who resigned that position to become associated with the War Production Board.

HORACE M KINNE, head of the media department, Allis-Chalmers Mfg Co, Milwaukee, Wis, has received a promotion and has left the advertising department to take charge of all the company's purchases of office supplies. Taking his place is John Priebe, who will handle all media duties formerly performed by Mr Kinne. Mr Priebe comes to the advertising department from the industrial relations department.

WILLIAM F BAILEY was recently appointed manager of the Porcelain Division of the Westinghouse Electric & Mfg Co. Mr Bailey, formerly auditor of the Switchgear Division at the Westinghouse East Pittsburgh works, takes charge of the Porcelain Department at a time when the construction of two new buildings is under way to increase production by 30%. Before joining Westinghouse in 1926 he was for six years manager of the Hydraulic Pressed Steel

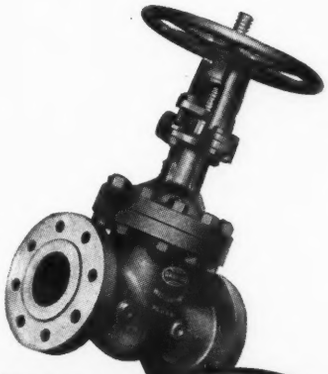
There's a Shortage of DARLING GATE VALVES IN THE JUNK PILE

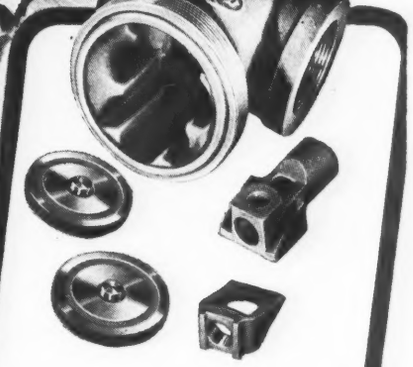
Today, junk piles are being combed for every valve that can be salvaged. Chances are, you won't find a single Darling Gate Valve—because they just *don't* end up in the junk pile! Darling Gate Valves stay on the job—right in the line—year after year—delivering tighter seating, better performance, less wear, more efficient operation at lower maintenance cost.

When, after long and severe service, the parts should become worn, there is no need to remove the valve from the line. You just replace 4 simple and inexpensive parts and the Darling Double Disc Gate Valve is again ready for long, hard service.

Darling Valves Are Still Available To Industry!

In spite of our heavy war production schedule, we *do have* industrial valves to sell—perhaps the very ones you need for that critical installation in your plant. We suggest that you phone, wire, or write, giving as much information as possible on your valve requirements, priority ratings, and all other data that will help us expedite shipments to you. Requests will be given immediate attention, in the order received at our plant.





Only 4 PARTS

Two discs and two wedges—the entire working part assembly of a Darling Double Disc Gate Valve. There is no other valve with this design. The seats are parallel. The discs are *fully revolving*, seating in a different position each time the valve is operated. This means tighter seating, less wear, longer operation and lower maintenance costs with Darling Gate Valves.

You don't have to take a Darling Double Disc Gate Valve out of the line to replace the parts. Simply insert new and inexpensive assembly parts and replace Stem and Bonnet. Valve is again ready for long, hard service.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

6 JOBS You Can Do Faster, Easier

1. Cleaning Heat Exchangers
2. De-Scaling Diesel Engines
3. Cleaning Lube Oil Coolers
4. Stripping Transformers
5. Cleaning Oil Preheaters
6. Cleaning Evaporator Coils

On these SIX jobs specialized, fast-working Oakite materials and methods are (1) conserving man-hours, (2) helping do maintenance work easier, with less manual effort, and (3) helping shorten equipment down-time for many concerns like yours. That is why we say . . . use performance-proved Oakite materials and see for yourself the big difference . . . the greatly improved results, the saving in time and effort, the economy . . . you get!

Do All Your MAINTENANCE CLEANING *the Faster, Safer Oakite Way*

NEW Oakite DIGEST gives details on 28 essential, commonly recurring maintenance jobs. Describes materials and methods used, the time saved and economies effected. Write for your FREE copy TODAY!

OAKITE PRODUCTS, INC.
23 Thames Street, New York, N. Y.
Representatives in All Principal Cities of the United States and Canada.

OAKITE *Specialized cleaning*
MATERIALS & METHODS FOR EVERY CLEANING REQUIREMENT

Co, Cleveland, Ohio, and for three years superintendent of the Erie City Iron Works, Erie, Pa. He was also in business for a short time as an industrial engineer.

A E DONKER, who has been in charge of the Washington office, has been made Eastern manager of the Honan-Crane Corp, Lebanon, Ind. Mr Donker will be located at 30 Church St in New

York. Continental Equipment Co, headed by M W Brooks, will continue to represent Honan-Crane Corp in New York. The Washington office at 508 Bowen Building will be in charge of M Parker Nolan.

HANS BOHUSLAV has joined the Sterling Engine Company as vice president in charge of engineering. Before coming to the company, Mr. Bohuslav was associated with the Enterprise Engine Co of San Francisco. During the ten

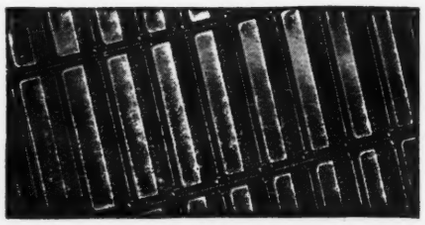
years he was with that company he served first as chief engineer and was later promoted to vice president in charge of engineering. He is known throughout the diesel and gas engine industry as an authority on the subject.

CHARLES N BARNEY of Scarsdale, N. Y., has been elected a vice president of the Worthington Pump and Machinery Corp, Harrison, N. J. A member of the Worthington organization since 1918, he has been treasurer since 1931, as well as the head of the cor-

BATESGRATES

FILLET WELD

Open Steel Floor Grating



Easily maintained - - -

NO CRACKS, JOINTS, CREVICES

Batesgrates are self-cleaning because of peaked, non-skid cross bar. They have no grooves or rough burned metal to catch grease or dirt. Safe traction. Batesgrates are strictly one piece—no cuts, slots, or punching. Made from Hexagon Shaped Hot Rolled Steel Bars with smoother, larger, much stronger welds. Send today for engineering Catalog No. 42.

When you need grates
SPECIFY BATES
for long-time economy

WALTER BATES CO.
208 S. LaSalle St. Chicago, Ill.

ROCKWELL'S complete line of Blast Gates includes all types: Slide, Kwikleen, Wafer, and Butterfly, in sizes up to 48". They are quick and easy to operate—strong, light, and durable. They can be supplied in monel, bronze, stainless steel and other alloys to meet individual requirements.

Write for catalog 4020, W. S. Rockwell Co., 50 Church Street, New York.

★ *Rockwell* ★
BLAST GATES

184,230 "arsenals" DEMAND

OIL WITH GUTS!

TOUGHER OIL MEANS LESS OIL, LESS OFTEN

Ask the Houghton Man

NO TIME TO LOSE . . .
NO REST FOR MACHINES . . .
LITTLE TIME FOR MAINTENANCE . . .

YES, keeping 'em turning 24 hours a day is a grueling test for lubricants . . .

But they can be made to meet it!

Machines today have no time off, except for bad behavior. One shift takes up where another left off . . . No chance for machines to cool off . . . little opportunity for preventive maintenance.

Speeds are high, hours long, as the Production Drive expands, reaching into every industry. This means that ordinary lubricants made for 40-hour weeks are destroyed *four* times as fast in the present continuous 24-hour, seven-day schedule.

Lack of a few drops of the right oil won't lose the war, but, multiplied many times in many thousands of machines, lubrication failure would constitute a serious draw-back to the Victory program.

But the bright spot in the picture of possible machine failure is the progress lubrication scientists have made in recent years. We "do things" to oils today that give them "*guts*"—the only word to express the qualities shop men know are needed and too often lacking.

These qualities may vary according to the application. High film strength to carry great loads, speeds and pressures . . . high oiliness values . . . retentiveness, or "stay-put" ability . . . stability—resistance to chemical change . . . high viscosity index . . . the ability to continue minimizing friction down to and including the last drop of oil should lubrication be stinted,—all these, and more, are being built into today's modern lubricants.

To these ends E. F. Houghton & Co. has contributed materially. Its research and development work years back has resulted in lubricants which provide that "extra" protection, because of its many exclusive methods of processing and treatment.

If you who are striving to meet and beat the pledges made to Uncle Sam would like to learn how these "extra" lubricants can stimulate your production, The Houghton Man is at your service.

E. F. HOUGHTON & CO.

MAIN OFFICE: 303 W. LEHIGH AVE., PHILA.

PLANTS: Philadelphia, Chicago, Detroit, San Francisco, and Toronto, Canada

FIRST AID FOR OVERWORKED MACHINES: **High-film-strength, polymerized Sta-Put Lubricants ★ Dynamo-Turbine-Compressor D. L. Absorbed Oils ★ Fortified-film, stable, "High-V. I." Hydraulic Oils ★ Reversible, smooth Absorbed Oil Greases for Ball and Roller Bearings ★ E. P.-treated Spindle Oils ★ Stable, strong Diesel Engine Oils ★ Extreme-Pressure-treated Gear Oils, and a host of others for 24-Hour War Plant Duty.**

Presenting FAIRCOSEAL BRONZE VALVES

To meet the increasing demand for valves that will withstand tension, vibration and torsional strains in non-ferrous piping aboard ships and in industry, Fairbanks presents FAIRCOSEAL VALVES . . . bronze valves with threadless pipe connections for making Silbraz joints.

In place of threaded pipe connections, Faircoseal Bronze Valves have recessed ends which contain pre-inserted rings of Sil-Fos silver brazing alloy. The pipe is cut with plain ends and brazed to the valve by the application of an oxy-acetylene flame.

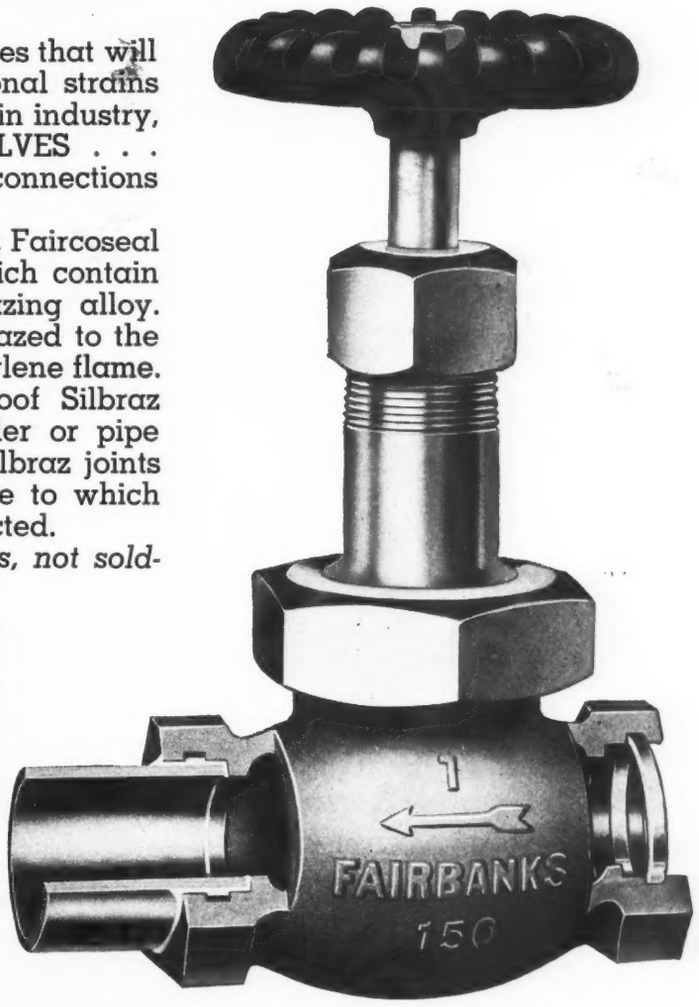
This makes a permanently leak-proof Silbraz joint without the use of wicking, solder or pipe dope. Having high tensile strength, Silbraz joints will not pull apart at any temperature to which the valve or pipe can be safely subjected.

Silbraz joints are *silver brazed joints, not soldered* joints.

Faircoseal Valves and Silbraz joints can be used with steam, oil, hot or cold water, compressed air, acid, Freon sulphur dioxide, etc.

Silbraz joints have been approved by the U. S. Navy for use aboard naval vessels and have been incorporated in many U. S. Army specifications.

Other features, too numerous to mention here, are explained in the new Faircoseal Bulletin FSV. Write for a copy, or mail the coupon.



Fairbanks F
Standard and Renewable **Valves**

P.

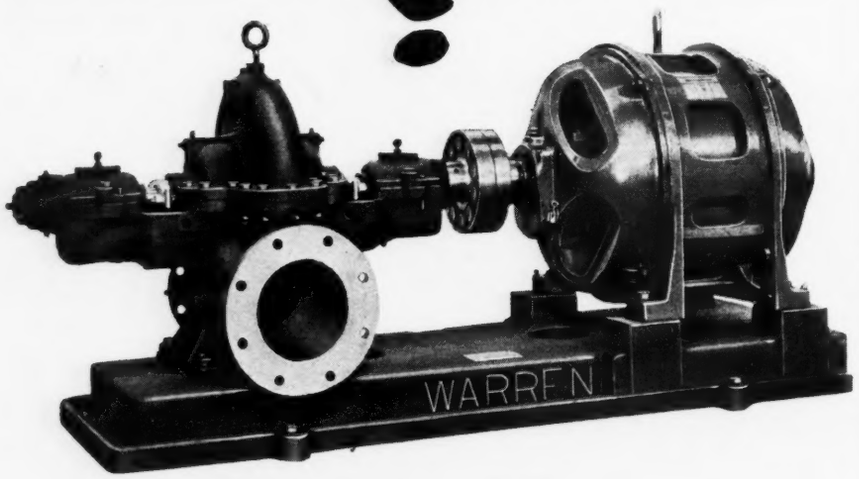
The Fairbanks Company,
397 Lafayette St., New York, N. Y.

Please send Bulletin FSV.

Name .....

Address .....

City ..... State



Not for These

WARREN PUMPS

In February, 1929, a large mill bought two Warren Pumps, each one to handle 1500 G.P.M. of a hot soluble compound, against a head of 58 feet.

Because of previous experience with other makes of pumps, a spare rotating member was ordered for each Warren Pump. Today, 13 years later, the spare parts are still in the boxes in which they were shipped, and have never been used.

If that is the kind of performance *you* want, get in touch with Warren.

WARREN STEAM PUMP COMPANY, INC., WARREN, MASSACHUSETTS

poration's legal department. Mr Barney formerly practiced law in Massachusetts and was a lecturer at Northeastern Law School and Boston University Law School.

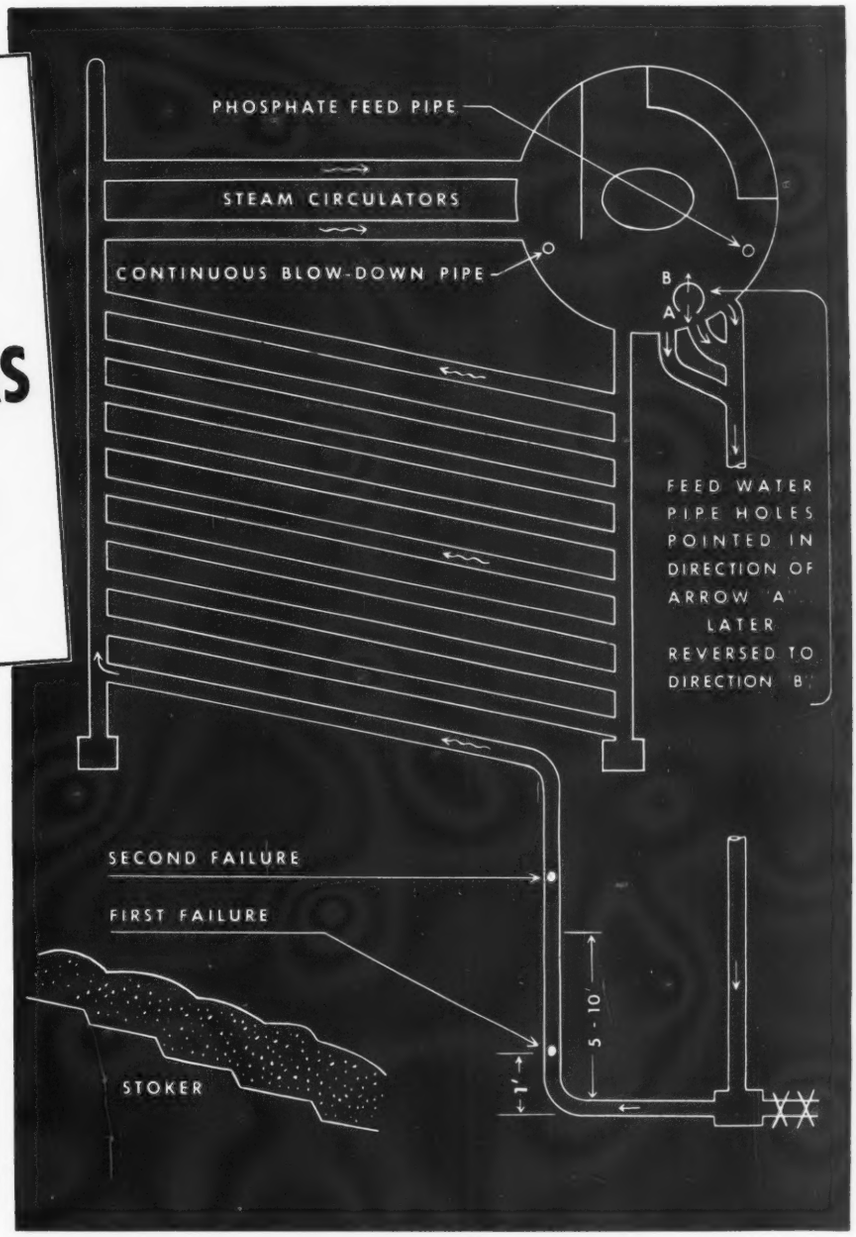
ROBERT WAGNER has been appointed Northeastern district manager of the Westinghouse Electric Elevator Co. Mr Wagner started with Westinghouse Electric Elevator Co, Chicago, in 1929, where he took the student course. Shortly afterwards he was transferred to the sales department doing negotiating and estimating work. From 1932 to 1939 Mr Wagner was a sales engineer in the San Francisco district office. His transfer to the New York office followed, and he has been there until the present time.

A J MOSES has been elected a vice president of Combustion Engineering Co, 200 Madison Ave, New York, N. Y. Mr Moses, a graduate of Georgia School of Technology, has been connected with the Combustion Engineering Co, or its constituent companies, since 1920, and for several years past has been general manager of the company's Hedges-

Walsh-Weidner Division at Chattanooga. He will continue to be responsible for operations of this major manufacturing division. Mr Moses is the author of numerous articles and society papers on welding and the fabrication of welded pressure vessels. His technical society memberships include the American Society of Mechanical Engineers, the American Society for Testing Materials, the American Welding Society, and the Chattanooga Engineers Club.

WILLIAM A MINKLER has been appointed sales manager of the Catalog Products Division of Young Radiator Co. Mr Minkler has served as assistant sales manager since 1939, under M F May, vice president in charge of heating, cooling and air conditioning products. Mr May will continue to supervise the catalog products sales program, and, in addition, will do special work in connection with the government and

NEW BOILER BURNS OUT TWICE IN 6 WEEKS ...WHY?



WHY should a new boiler rated at 65,000 lbs. of steam per hour and 420 lbs. pressure burn out 4 tubes low down in the rear water wall during the first month? First thought—maybe it was too frequent blowdown of the rear water wall.

Then why, after locking the blowdown connections and welding in new tube sections, should seven tubes fail higher up within just two weeks of operation?

Was it caused by untreated water reaching the affected tubes? The plant staff didn't think so. Their tests showed nothing wrong. The boiler drum and visible tubes were clean as a whistle.

Having done what they could, they sent for a Hall Service Engineer. His examination showed no unusual conditions in tubes or drum. The boiler was in excellent shape. Then a section of one of the bagged tubes was cut out. In this was found an extremely thin, brittle coating of a grayish crystalline scale. Analysis showed largely calcium sulphate and a small amount of calcium carbonate. That could mean only one thing — untreated water *was* reaching the affected tubes. But how?

He inspected the drum again. This time he noted that the holes in the boiler feed pipe were directed downward. If untreated feed water was reaching the tubes, this was a way it could do it.

Then he checked the boiler blueprints. Sure enough, the feed holes should have been directed upward. Here was the needle in the haystack. He rotated the pipe 180°. That was months ago. There has been no more trouble with burnt out tubes.

There you have another of the thousands of cases where a Hall Engineer working with the plant staff keeps boilers on the line, another proof of the value of expert engineering knowledge in connection with water conditioning service.

Never has a protective boiler water conditioning service of this kind meant more to you than now. Why not ask us to explain it to you?

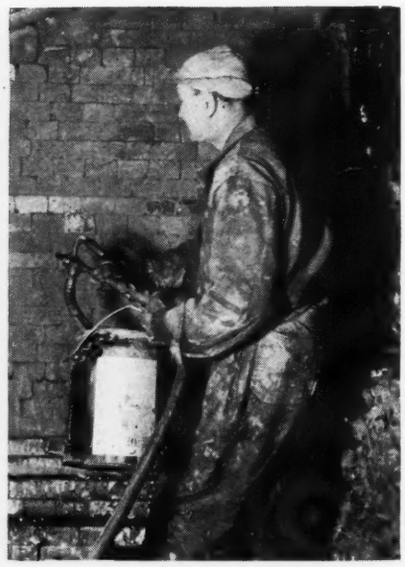
HALL LABORATORIES, INC. · 300 ROSS STREET · PITTSBURGH, PA.

HALL SYSTEM *of Boiler Water Conditioning*

Protect against spalling and cracking

by ARMOR PLATING REFRACTORY LININGS with

BRICKSEAL



By forming a highly glazed semi-plastic surface over refractories, BRICKSEAL seals pores, completely stops infiltration of gases and carbon and minimizes the cause of spalling and cracking.

BRICKSEAL is a combination of high fusion clays and metals combined in oils. It is unaffected by gases, acids or alkalis and is *guaranteed* not to crack, peel or blister under a wide range of temperatures.

EASILY APPLIED TO ANY SURFACE

Any refractory surface may be "armor plated" with BRICKSEAL which can be applied by air-spray gun or by hand brush quickly and easily. A proper BRICKSEAL application stands up effectively from one to four years. Ideal for new construction or maintenance requirements. Tried and proved in every type of boiler under all conditions.

INVESTIGATE TODAY
—by sending for complete details.

ATTENTION DISTRIBUTORS
Desirable openings are available for sales representation in certain territories. Write for details.

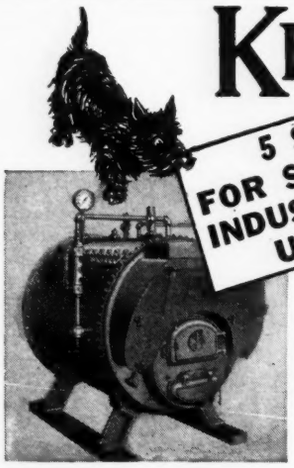
BRICKSEAL REFRACTORY CO.
1029 Clinton St., Hoboken, N. J.

Cuts your gasket costs in half

The most remarkable tool ever invented

Write for booklet

THE ALLPAX GASKET CUTTER
Manufactured by
THE ALLPAX COMPANY, INC.
Distributors everywhere ***Mamaroneck, N. Y.***



KEWANEE

5 SIZES FOR SMALL INDUSTRIAL USES

SCOTTIE JUNIOR BOILER

. . EACH ONE A REAL FUEL SAVER

High Pressure Steam at Low Cost . . . economical to buy and economical to operate. Compact yet easily accessible. Easy payments in accordance with U.S. Government regulations thru our Finance Corporation.

For 6" rule with scale for reading pipe sizes, write Dept. 99K-VII

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS

war effort activities. In his new capacity, Mr Minkler will direct Young Radiator headquarters sales staff as well as more than 60 sales representatives from coast to coast.

JOHN W SCOTT of Indiana has been reappointed a federal power commissioner by the President, for a second term ending June 22, 1947. Mr Scott's current term expires on June 22, the only vacancy scheduled to occur in the Federal Power Commission this year.

BUSINESS ITEMS

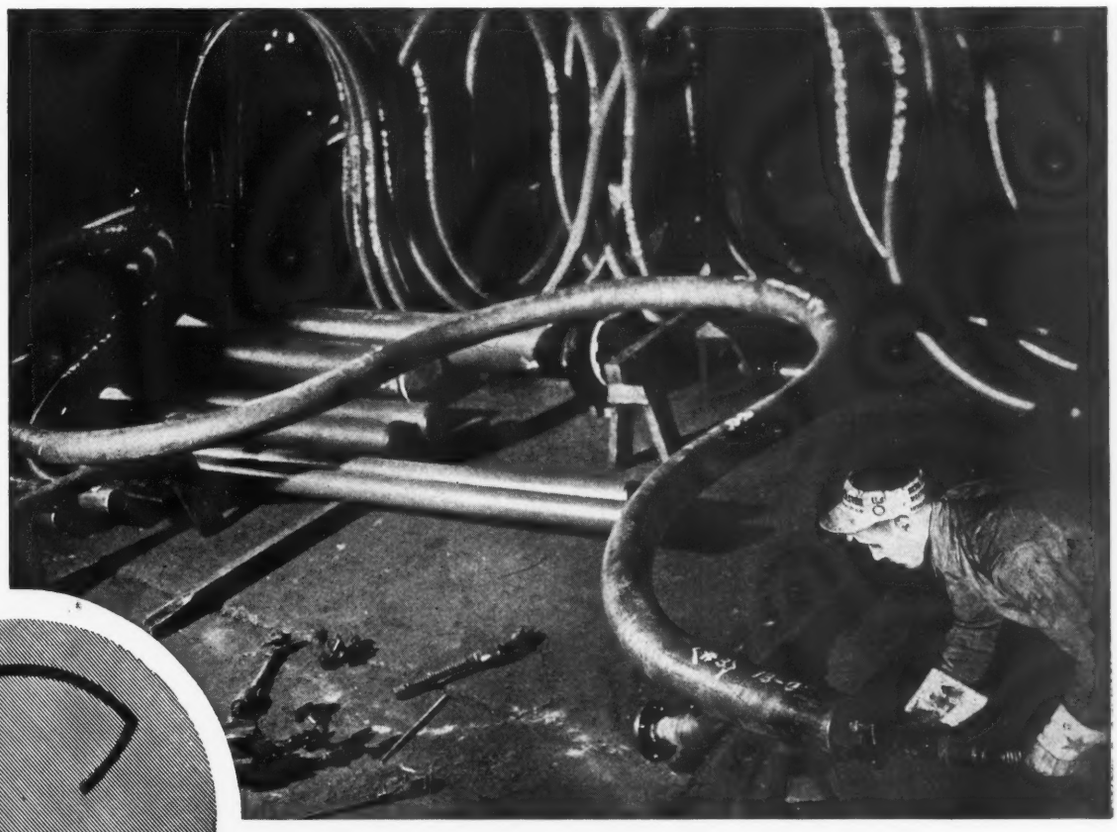
A $6,800,000 steam plant to generate electric power will be built for the VIRGINIA ELECTRIC & POWER Co on the James River in Chesterfield County about ten miles east of Richmond, Va. Contract for the construction of the plant is held by Stone & Webster Engineering Corp, and work is already under way. The plant will have a large power output and is being built to handle the increased load on the company's system.

THE WHITTY Co, INC, combustion engineers, has consolidated its offices, factory and service department at 86 Western Ave, Boston, Mass (Brighton district).

THE TIMBER ENGINEERING Co, Washington, D C, has been receiving requests for aid in designing wood towers for water tanks as a result of a decision by the War Production Board to decline priorities for steel to be used in the construction of water towers. The company offers cooperation to any recognized engineer in designing tank towers and will send complete design data and recommendations to assist in design work.

ROBERT L COE, vice president of Chase Brass & Copper Co, Waterbury, Conn, was elected president of the COPPER & BRASS RESEARCH ASSOCIATION, 420 Lexington Ave, New York, N Y, at a recent election. He succeeds John A Coe, president of the American Brass Co, Waterbury, Conn. Other officers elected were John A Coe, Wylie Brown, R E Day, C L Smith and Wm M Goss as vice presidents; C Donald Dallas, president, Revere Copper & Brass Inc, treasurer; T E Veltfort, manager, and Bertram B Caddle as secretary.

Employees of the FOXBORO Co, Foxboro, Mass, who had completed 25 years or more in its service were guests of the company at a celebration May 26. A jeweled service pin of gold was pre-



Craftsmanship

NAVCO

POWER PLANT PIPING

• The bending of pipe is an operation which requires considerable more skill than is evidenced by mere observation.

Of great importance is the manner in which the pipe is prepared to insure the finished bend having a smooth, clean inner surface free of embedded impurities, wrinkles or buckles.

For hot bending, Navco shops are equipped to mechanically ram a special grade of sand compactly in the pipe, thus insuring a minimum amount of thinning in the outside wall.

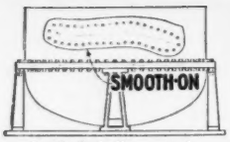
Before shipment, every Navco pipe bend is internally turbined with tube cleaner to remove all traces of sand or scale. Where such scale and sand is not removed, it will frequently loosen up in service and destroy turbine blading and valve seats, clog traps and in short, impair the operation of any mechanical equipment to which the piping system is connected.

Every pipe bend and every piece of piping material turned out by Navco shops is of a distinctly superior type of craftsmanship. It has been fabricated by master craftsmen.

NATIONAL VALVE & MFG. CO., PITTSBURGH, PA.

[ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA]

SMOOTH-ON helps protect production schedules



Cracked shell repaired with Smooth-On

Leaking pipe connection made tight with Smooth-On

Every repair on a cracked casting or a leaking seam means loss of time which, today, may be even more important than the money cost of the repair.

To cut down repair time on many trouble jobs that would cause interruptions to production . . . use SMOOTH-ON No. 1, the iron repair cement of a thousand uses, proven by 47 years on the market.

SMOOTH-ON repairs do not require dismantling of apparatus, the use of heat, or special tools.

SMOOTH-ON is the speediest way of repairing cracks, leaks and loose parts, and the results are lasting. That is why experienced engineers all over the country always make sure to keep a can of SMOOTH-ON handy.

Buy Smooth-On in 1-lb., 5-lb. cans or 25-lb., 100-lb. kegs from your supply house or if necessary, from us. For your protection, insist on Smooth-On—used by engineers since 1895.

FREE

The Smooth-On Handbook—40 pages with 170 diagrams and concise, easily followed instructions for practical equipment repairs, based on the experiences of thousands of engineers. Send the coupon for your copy.

SMOOTH-ON MFG. CO., Dept. 30
570 Communipaw Ave., Jersey City, N. J.
Please send SMOOTH-ON HANDBOOK.

Name .....

Address .....

.....

7-42

Do it with
SMOOTH-ON

sented to each of the 50 men and women honored.

THE MCCLAVE CO, 751 Mill St, Allentown, Pa. announces the following additions to its sales organization: H T Warren has been appointed manager of sales for the Central New England district sales territory, with headquarters in Room 206, 125 Trumbull St, Hartford, Conn. D H Hull has been appointed manager of sales for the Memphis district sales territory, with headquarters at 1292 Mississippi Ave, Memphis, Tenn. A W Fish, formerly associated with the Buick Motor Car Corp, has been appointed manager of sales for the Central New York State sales territory, with headquarters at 857 Sumner Ave, Syracuse, N. Y.

CALUMET & HECLA CONSOLIDATED COPPER CO, A E Peterman, president, announced the purchase of the entire assets and liabilities of the Wolverine Tube Co, Detroit. It will be known as the Wolverine Tube division of Calumet & Hecla Consolidated Copper Co. Otto Z Klopsch will serve as general manager of the Wolverine Tube division.

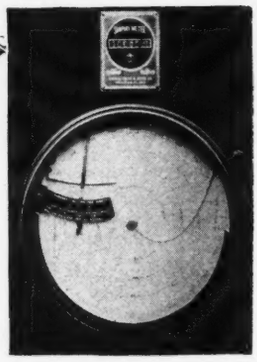
ROGERS DIESEL AND AIRCRAFT CORP is the new corporate name of the Cummins Diesel Engine Corp of New York. The corporation operates two New York plants, 1120 Leggett Ave, and 724 Garrison Ave, with offices at the former address. Originally formed in 1934 as a distributing organization for Cummins diesel engines, the corporation has since enlarged its scope of operations and its facilities to the point where a new corporate name was needed to describe more adequately the nature of its business. Although continuing as a distributor for Cummins engines, the company now represents Enterprise and Sheppard diesel engines also.

WHEELCO INSTRUMENTS CO, Chicago, has announced the appointment of four new district representatives. Pasol Engineering Co has been named Iowa and Nebraska representative, with V E Lindquist in charge of the Iowa office at Des Moines, and I I Solzman heading the Nebraska office in Omaha. Fitzgerald Inc, Wichita, has been assigned to the Kansas territory, with Bloyce Fitzgerald in charge of instrument sales. Charles A Drum, Houston, has been named Texas district sales manager.

GENERAL ELECTRIC CO announces personnel changes, awards and promotions.. William M Denny has been named manager of the contract service

HERE'S THE FLOW RATE CHART THAT'S REALLY *Easy to Read*

GET THE WHOLE STORY AT A GLANCE!



Why worry with factors and "microscopic" low rate readings when all Simplex MS meters use an evenly spaced chart—with even graduations from O to maximum.

WHAT DOES THIS MEAN TO YOU ?

1—The direct reading chart with O factor only assures the same high accuracy and ease of reading anywhere in the flow range from minimum to maximum flow.

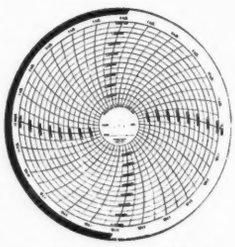
2—Even graduations make it easy to read low as well as high flows from a distance.

3—Greater accuracy of chart readings from planimeter.

4—Extreme accuracy of chart record is inevitable since pen arm connects directly with bell-shaped float.

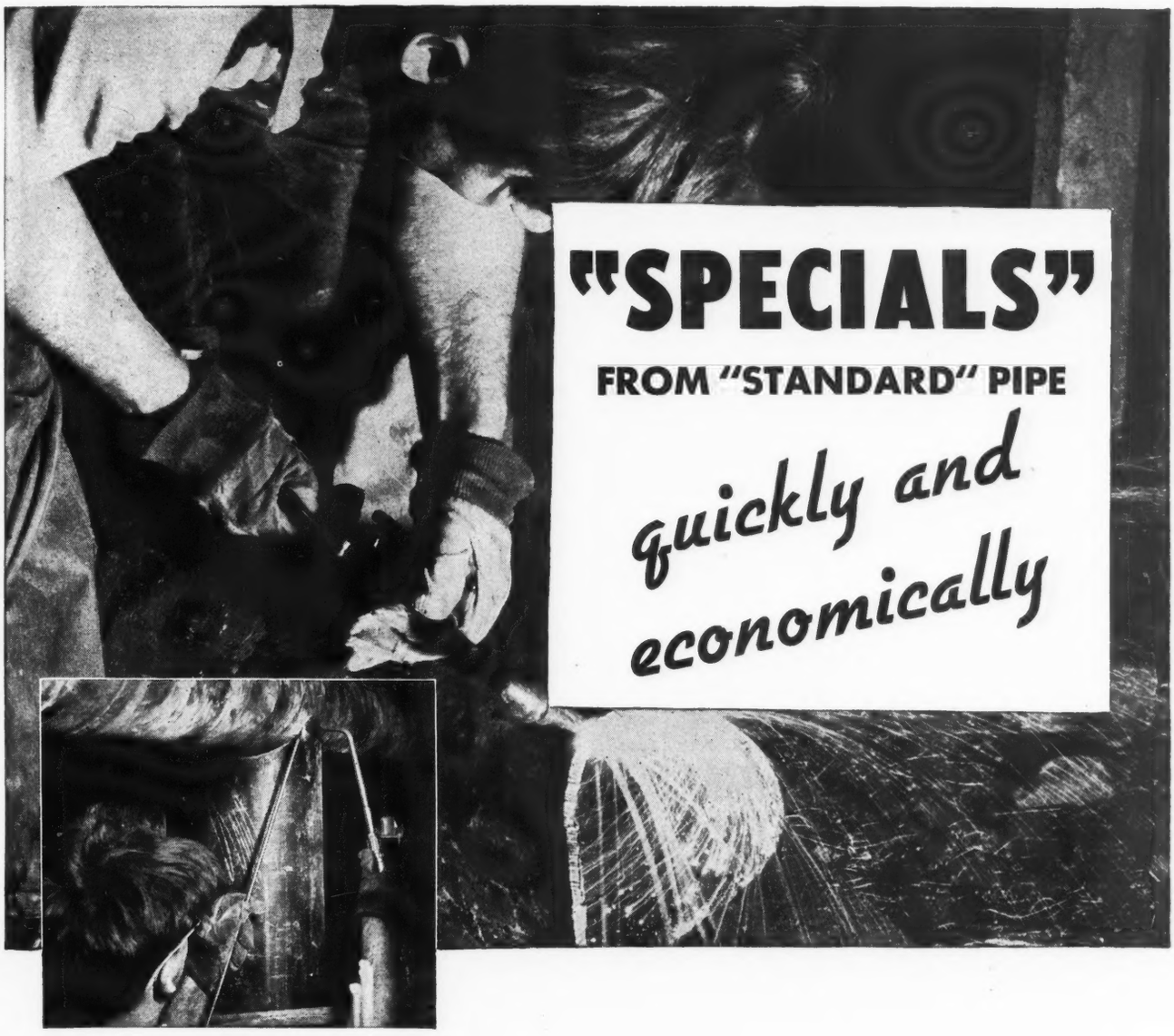
5—Special moisture proof paper eliminates stretching and shrinkage—chart cannot slip in use.

Simplex has "engineered" the chart on the MS meter as well as every mechanical detail. This direct reading chart is made possible because of the unique bell-shaped float which extracts the square root of the law of flow. Here is accuracy, ease of recording, and ease of reading—yours for the using in every Simplex Type MS meter. There is no finer meter at the price. Specify Simplex MS meters. Write for details today.


12" circular chart for daily or weekly removal. Electric or mechanical clock drive.

SIMPLEX VALVE & METER CO.
6780 Upland Street, Phila., Pa.

SIMPLEX METERS
THE METER WITH THE BELL SHAPED FLOAT



Don't let the scarcity of special pipe fittings handicap you. Make full use of your Airco Torch to shape standard pipe by cutting, bending and welding to fit your special requirements. It's a widely used procedure in these times. A trained oxyacetylene torch operator can produce a variety of strong, integral, leakproof fittings, quickly, at low cost.

Air Reduction's wartime policy is to help American industry do the tough job we all face. Our nation-wide field engineering service and our research facilities on any problem involving the oxy-acetylene flame and the electric arc are available.

Air Reduction

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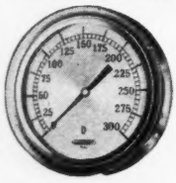
IN TEXAS
MAGNOLIA-AIRCO GAS PRODUCTS CO.
General Offices: HOUSTON, TEXAS
OFFICES IN ALL PRINCIPAL CITIES

AIRCO

WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

for EXCEPTIONALLY LONG LIFE and ACCURACY—



This Lonergan Type "D" steam, air and pressure gauge is recommended particularly. Like all Lonergan products it is precision-built by master craftsmen . . . *guaranteed* for perfection of materials and workmanship.

Details on request.

Lonergan

70th Anniversary

★ SINCE 1872
MANUFACTURERS OF PRECISION

Valves • Gauges Specialties

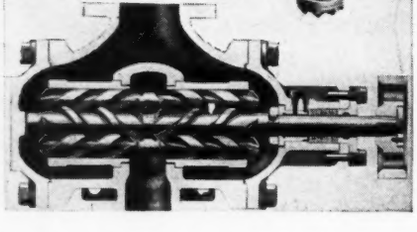
J. E. LONERGAN CO.
Race and Second Sts.
Philadelphia, Pa.

for High Pressure **LUBE OIL**

This De Laval-IMO

rotary displacement pump, directly connected to a motor running at 1450 r.p.m., delivers oil against a pressure of 330 lbs. per sq. in. to the lubricating system of the vertical thrust bearing of a large hydraulic turbine. The pump end is submerged in the oil sump. There are no valves, no gears and no pump bearings. The flow is without pulsation, as from a steadily advancing piston. Ask for Catalog I-94.

IMO PUMP DIVISION
of the
De Laval Steam Turbine Co.
Trenton, N. J.



department. He succeeds Frederick P Wilson, who retired after 51 years' service. C F Pittman, manager of the motor division, industrial department, has been named assistant to the manager of the industrial department. Mr W H Henry, who was manager of sales in the motor division, succeeds Mr Pittman as manager of the division. Ira A Terry, for the past two years assistant to J D Harnden, engineering assistant to the manager of General Electric's largest plant, has been appointed to general assistant to H A Winne. Walter C Heckman, of the G E turbine engineering department, has succeeded Mr Terry in the works manager's office.

A W Robertson, chairman of the Westinghouse Electric & Mfg Co recently conferred the Westinghouse Order of Merit on G Edward Pendray, assistant to the president in charge of publicity and advertising, and James Boyd, Eastern district manager. Mr Pendray was cited "for his profound understanding of the mind of the public in its relation to a large industrial organization; for his sound and effective administration of publicity and advertising, and for his ability to combine individual initiative with cooperation within the company." Mr Boyd's citation was "for his clearsighted, practical sales ability in serving a complicated metropolitan area; for his management of a sales organization under difficult conditions existing in that area; and for his personal salesmanship and courage in handling large and difficult negotiations."

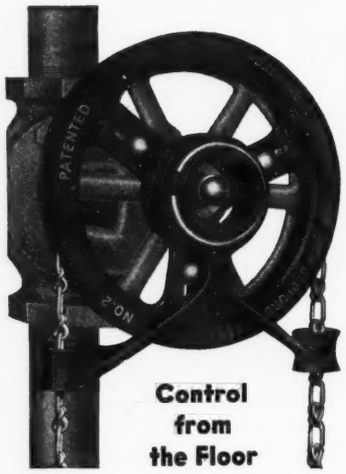
Moore Machinery Co, 1699 Van Ness Ave, San Francisco, have recently been franchised by Whiting Corp of Harvey, Ill, to represent them in California, Arizona and Nevada.

Electrical Testing Laboratories, Inc, has acquired the plant and equipment and has taken over the staff of Electrical Testing Laboratories, and now offers its services to government and industry. These services consist of electrical and general testing, inspection, analysis, research and certification. Preston S Millar is president, F Malcolm Palmer is vice president and chief engineer of the new group, located at 2 East End Ave, New York, N Y.

Fin Tubes Save Metal

Fin tubes in heat exchanger equipment saves an appreciable amount of the metals originally required for tube

Make Your Overhead Valves SAFE And Easy to Reach---



Control from the Floor

With the Babbitt Rim for Valves you eliminate danger and banish the step-ladder. You can now place your valves wherever they come economically and conveniently. They fit any valve. Let us tell you more about them. Write today.

BABBITT STEAM SPECIALTY CO.
New Bedford, Mass.

HERCULES
Seamless Copper
FLOATS

GUARANTEED TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

NOW THAT IT IS IMPORTANT TO OUR COUNTRY TO INCREASE THE LIFE OF TUBES

A TIMELY MESSAGE FROM OUR MAINTENANCE DIVISION

Hydro-Dynamic Shock Testing of Tubes

Don't re-tube before shock testing. The Maintenance Division of Condenser Service & Engineering Company has developed—by study and experiment—ways and means of adding many years to the service life of condenser and heat exchanger tubes.

HELP YOUR GOVERNMENT SAVE A MILLION POUNDS OF TUBES . . .

Many condensers are re-tubed because 200 or 300 tubes have failed and are plugged. Hundreds of installations prove that the application of a suddenly applied, high pressure test to each tube detects the weakened tubes and saves the usable tubes for at least double service life.

Pitting and Corrosion

When pitting and corrosion cause leaks, shock test every tube. The greater majority of the tubes are found good and can be used as replacements in other condensers. You can never be sure you are saving a bad tube or scrapping a good tube until our hydro-dynamic shock test has supplied the answer. *Guessing is wasteful.*

Stretching Worn Tubes

Millions of tubes are removed and new ones installed in condensers and heat exchangers because the old tube ends are completely worn through. We *stretch* the tubes and cut off the bad ends.

FLOWRITES prevent failures

When tube ends show wear, further destruction can be prevented by the installation of FLOWRITES, a replaceable sleeve that takes the wear and saves the long tubes.

...FOR CONDENSERS ...FOR ALL HEAT EXCHANGERS

WE can save millions of pounds of scarce material by practical and time-tested methods.

Our design and new construction division continues to function in almost 100% war work. Our redesign and rebuilding division continues to save the building of many new units.

W. P. B. URGES YOU TO SAVE BRASS

STOP USING FERRULES!

It is our duty to stop using ferrules for the duration of the war. The real savers of scarce materials will roll tubes at both ends, at least for the duration. If you must use packing, use fibre. Don't use metallic packing, save metal.

FIBRE PLUGS PREVENT TUBE SHEET DAMAGE

Tubes in any condenser or heat exchanger will leak at some time and require plugging. If tubes carry fluids at not more than 200°F., use only fibre plugs. Simplest to put in . . . do not require driving; a light tap closes the tube, preventing damage to the tube sheet . . . fibre plugs swell, to seal the tube permanently . . . they are not porous . . . easy to remove . . . *by far the best.*

●

CONDENSER SERVICE & ENGINEERING COMPANY

HOBOKEN, NEW JERSEY Hoboken 3-4425

MAINTENANCE WORK ANYWHERE IN NORTH AMERICA

ADAMANT
JOINTS ARE AS STRONG AS THE BRICKS THEY BOND

Impartial laboratory tests made by one of the leading technical institutes in the country, have shown that —

ADAMANT
FIRE BRICK CEMENT

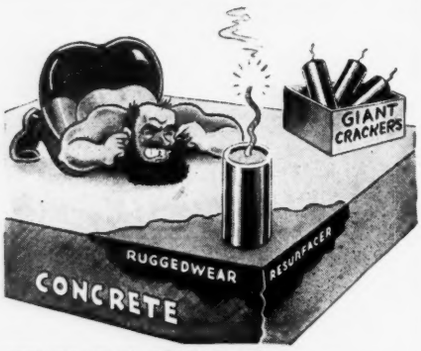
has a bonding strength of 800 lbs. per sq. in. at room temperature, and 1270 lbs. per sq. in. at 2600° F. ADAMANT has a P. C. E. of over 3000° F.

No wonder that users everywhere report that furnace linings laid up with ADAMANT Fire Brick Cement give far longer service.

Over 66% of the dry material passes through a 200 mesh standard Tyler sieve, insuring extreme smoothness.

Let us send you more facts about ADAMANT and other Ada-Products. Write—

BOTFIELD
REFRACTORIES COMPANY
784 S. Swanson St., Philadelphia, Pa.
In Canada, Canadian Botfield Refractories Co. Ltd. 171 Eastern Avenue, Toronto



TOUGH PATCH
For BROKEN CONCRETE

Repair holes, cracks, broken places in concrete floors to a tough, feather edge . . . with durable RUGGEDWEAR RESURFACER. No chopping or chipping required. Merely sweep out spot to be repaired—mix the material—trowel it on. Holds solid and tight right up to irregular edge of old concrete. Provides smoother, firmer, more rugged wearing surface. Used indoors or out, for patching or complete overlays. Dries fast.

Request valuable descriptive bulletin on "TOUGH FLOORS"

MAKE THIS TEST!

FLEXROCK Co.
2377 Manning St., Phila., Pa.

Please send me complete RUGGEDWEAR information . . . details of FREE TRIAL OFFER—no obligation.

Name .....
Company .....
Address .....

construction, it was declared in a paper prepared for delivery before the mid-year meeting of the American Society of Mechanical Engineers at the Rice Hotel, Houston, Texas, March 24 by A Y Gunter, development director of the Alco Products Division of American Locomotive Company.

He estimated the saving effected by this type of equipment in many cases may be as much as 40%.

Use of fin tubes where applicable in the place of bare tubes, the more conventional type, in heat exchangers makes a saving of from 65 to 75% in the number of tubes required, he pointed out.

Gunter is a graduate of Texas Agricultural and Mechanical College. In junior college days he was state tennis champion, and is now president of the New York Texas A & M Club.

Mr Gunter said that oil exchangers containing the fin-tube construction are being used importantly in U. S. Navy shore bases and on U. S. destroyers, cruisers and other warships, as well as in the oil industry throughout the country.

Welding Society to Hold 23rd Annual Meeting

The American Welding Society will hold its 23rd annual meeting this year, it was announced by the executive committee. In making the announcement society officials expressed the belief that the best interests of the war effort would be served by intensifying their educational engineering program.

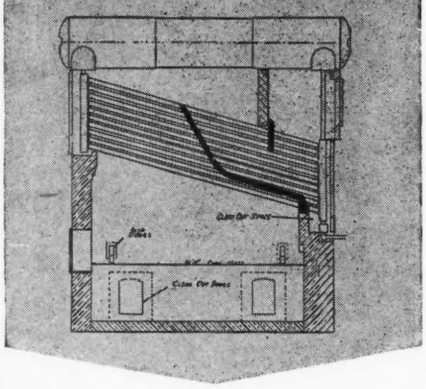
"So important to the war effort", said Col Glen F Jenks, society president, "is new information pertaining to latest advances in applying welding to military production that the American Welding Society feels it an obligation to assemble this year for interchange of ideas by its members."

Welding is a key process in the production of war equipment, according to Col Jenks. It is making possible the construction of all types of ships at much higher speeds. Welding applied to construction of guns increases their strength and effectiveness and makes them easier to move and position because of reduced weight.

"Now, more than ever before", said Col Jenks, "the nation needs the thinking and experience of welding authorities to speed up production of ships, planes, tanks, guns and other equipment essential for war.

"From the standpoint of contributing to the national effort", Col Jenks

ANY type of boiler will deliver MORE POWER at LESS COST with Enco Streamlined BAFFLES

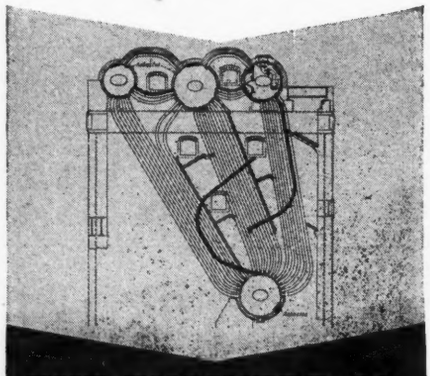


THE cross-flow principle of Enco Streamlined Baffles with its higher efficiencies, may be applied to any type of boiler—horizontal or vertical, straight or bent tube.

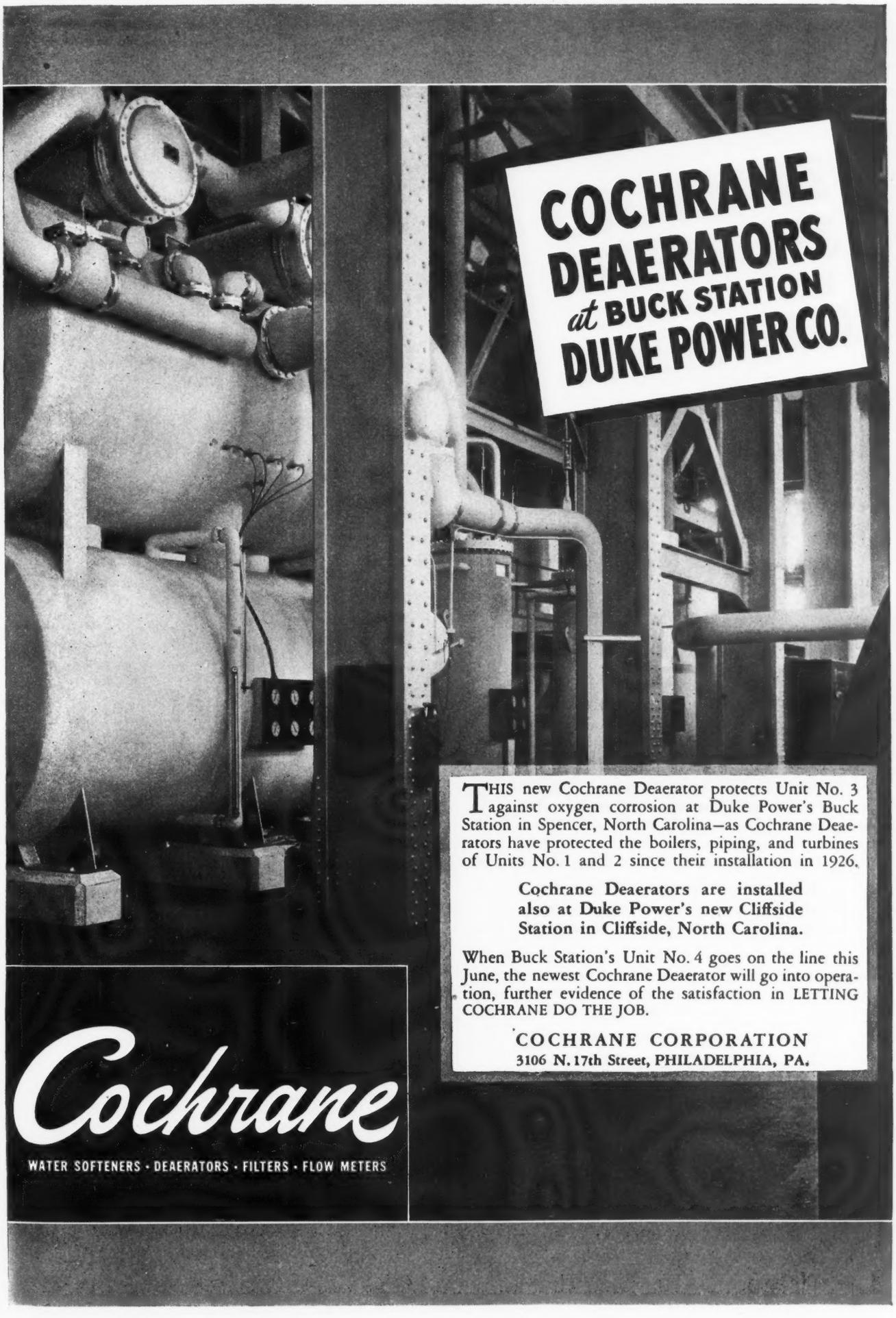
By streamlining and curving, gas passages are tapered to maintain velocity as the gas volume is reduced, resulting in a higher rate of heat transfer to boiler and superheater surfaces, and lower flue gas temperatures.

Enco Streamlined Baffles reduce draft loss by eliminating eddy currents, bottlenecks and dead gas pockets—save steam because soot blowers work less often and more effectively.

Ask for Bulletin BW-40 containing valuable engineering data on modern baffle wall construction—It's free.



THE ENGINEER CO.
Enco 75 West St. New York, N. Y.



THIS new Cochrane Deaerator protects Unit No. 3 against oxygen corrosion at Duke Power's Buck Station in Spencer, North Carolina—as Cochrane Deaerators have protected the boilers, piping, and turbines of Units No. 1 and 2 since their installation in 1926.

Cochrane Deaerators are installed also at Duke Power's new Cliffside Station in Cliffside, North Carolina.

When Buck Station's Unit No. 4 goes on the line this June, the newest Cochrane Deaerator will go into operation, further evidence of the satisfaction in LETTING COCHRANE DO THE JOB.

COCHRANE CORPORATION
3106 N. 17th Street, PHILADELPHIA, PA.

Cochrane

WATER SOFTENERS • DEAERATORS • FILTERS • FLOW METERS

FOR...
ARCHES
ASH PITS
BAFFLES
BRIDGE WALLS
BURNER BLOCKS
DOOR LININGS
STOKER SETTINGS

USE EASY-TO-GET CASTABLE REFRACTORIES

Jointless walls and arches are quickly cast in place, special shapes easily molded, with these ready-to-use mixtures of refractory aggregates and LUMNITE.

POWER PLANT operators keep Castable Refractories in stock for general refractory work, for emergency repairs and for making special shapes without delay.

Refractories without delay—today that's an important advantage of a Castable Refractory. You can take a bag of the dry castable, mix it with water and cast it in place. You need only a simple form for your wall or arch, a home-made mold for your special shapes. A Castable Refractory made with LUMNITE is ready for service within 24 hours after mixing.

Note these advantages of Castable Refractories:

No cutting or fitting. The Castable Refractory takes the shape of the form, mold or frame.

No ramming. After mixing with water the material is cast and simply tamped in to consolidate it.

Practically no shrinkage in drying or firing. No allowance need be made for shrinkage or expansion.

Unaffected by moisture, steam. High resistance to spalling.

▶ To get these advantages and to be assured of performance, power plant engineers specify Castable Refractories made with LUMNITE. When you buy a LUMNITE Castable Refractory, you get a ready-to-use, balanced refractory—the result of careful selection of the most suitable refractory aggregates and the hydraulic binder which made Castable Refractories possible.

Castable Refractories of different types to meet different temperature and insulation requirements are made by manufacturers of refractories and are sold by their distributors throughout the country.

The Atlas Lumnite Cement Company
(United States Steel Corporation Subsidiary)
Chrysler Bldg., N. Y. C.

Specify **CASTABLE REFRACTORIES**
MADE WITH LUMNITE

said, "nothing can replace the annual meeting of the technical society. From the preparation of technical papers on latest welding practices, from the exhibits of latest welding equipment, and from the discussions of timely subjects by authorities in their respective fields, information is revealed and disseminated which would not be made generally available otherwise.

Conservation of Critical Materials Stressed

"It is imperative to save every ounce of copper, rubber, zinc and steel and make sure every job goes in using the minimum of victory material," declared J F Porter, Jr, vice-president Kansas City Power and Light Company, in an address before the Annual General Power Conference, Edison Electric Institute, held recently in Chicago.

By correcting power factor in certain devices such as fluorescent lamps, induction motors, etc, he stated, useful capacities can be doubled.

The development of new materials and wiring devices has been a great contribution to the saving of critical materials, Mr Porter pointed out. He further stated that CNX, Knob and Tube and Romex were included in the order named on the government Critical List for defense housing. On March 12, the National Electrical Code Committees for Articles No. 300 and 310 recommended the adoption of CNX for residential and war emergency construction.

"We know that a better, more intelligent engineered use of present wiring materials will save quantities of copper, rubber, zinc and steel," he continued. Mr Porter emphasized the need for coordination of all allies in the industry if these maximum savings are to be realized. He pointed out the scope of this cooperative work in Kansas City, stating that nearly 200 houses outside the City limits have been wired with CNX.

"By power factor correction, use of new wiring materials and improvement of engineering and design in commercial and industrial wiring, great savings in Victory materials can be secured. Our part as electric companies is to supply the local electrical industry in our own communities the help in working together which they have the right to expect from us," Mr Porter concluded.

United WE WORK

The American tradition for fearlessness at the front, bravery in battle, is a priceless heritage. And the brave men of '42 are nobly living up to that tradition. We are likewise proud of the spirit being shown by our men on the "production front." These men are blazing new trails of tradition — setting up new standards of co-operation and hard work, building the Industrial Fans, Blowers, Unit Heaters, Fluid Drives and Mechanical Draft Equipment that have to come before the guns and bullets, tanks, trucks, ships and planes can be produced in overwhelming quantities. Much of this same equipment is going into the offensive weapons of both Army and Navy, too. We are proud to be a part of the Arsenal of Democracy . . . proud, too, that American Blower men are WORKING with all their might and main for Victory.

MECH. DRAFT · AIR-CONDITIONING
AMERICAN BLOWER
FLUID DRIVES · DUST COLLECTORS

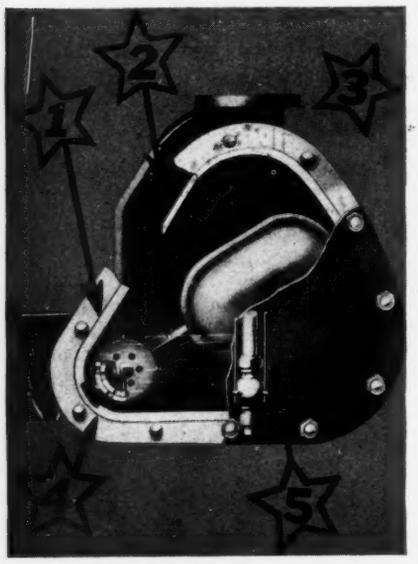
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
In Canada: CANADIAN SIROCCO COMPANY, LTD., Windsor, Ont.

Division of AMERICAN Radiator and "Standard" Sanitary Corporation

5 reasons why COCHRANE MULTIPORT DRAINER

is the IDEAL DRAINER



1. ONLY ONE MOVING ELEMENT, with rotating valve directly attached to float stem, all self contained within an integral housing.
2. TREMENDOUS DISCHARGE CAPACITY is assured by unusually large port areas. Condensate is discharged through a rotating cylindrical valve, as through an orifice, except that there are 6 such orifices in the valve.
3. POSITION HANDLE on outside of body permits closing valve or opening it wide: full opening thus secured serves as an effective blow off.
4. COMPLETE ACCESSIBILITY of valve is provided by removable cover plate, without necessity of disturbing mechanism or piping connections.
5. GAGE-GLASS, with guards and try cock, shows visibly the height of condensate at all times.

Write for a copy of Publication 2925.

COCHRANE CORP., 3106 N. 17th St., Philadelphia, Pa.

Cochrane

Charles E Wilson Elected ACRMA President

Charles E Wilson, vice president of the Worthington Pump and Machinery Corporation, was elected president of the Air Conditioning and Refrigerating Machinery Association, Inc, in its Annual Meeting held in New York City May 8.

Other officers are J P Rainbault of the General Electric Co, first vice president; W H Aubrey of the Frick Co, Inc, second vice president; and P A McKittrick of the Parks-Cramer Co, treasurer.

S E Lauer, president of the York Ice Machinery Corporation, was elected to the chairmanship of the ACRMA Board of Directors. In addition to the officers, the members of the Board are: P Y Danley (Westinghouse Electric and Manufacturing Co), F T Goes (The Vilter Manufacturing Co), G A Heuser (Henry Vogt Machine Co), J K Knighton (Servel, Inc), E T Murphy (Carrier Corporation), D W Russell (Airtemp Div, Chrysler Corp), H R Sewell (B F Sturtevant Co), W E Wallis (The Creamery Package Manufacturing Co).

William B Henderson continues as executive vice president of the Association.

✦ ✦ ✦

A H Pritchard, left, specialist on steam turbine lubrication for Socony-Vacuum Oil Co., was agreeably surprised recently when his associates presented him with a wrist watch on the occasion of his 30th anniversary with the company. W. H. Correa, right, manager of the Lubricating Department, made the presentation

MEETINGS

15th National Exposition of Power and Mechanical Engineering—*Grand Central Palace, New York, November 30 to December 5, 1942.*

Technical Association of the Pulp and Paper Industry (Tappi)—*27th Fall Meeting, September 30–October 1, 1942, Hotel Statler, Boston, Mass. National Headquarters, 122 East 42 St, New York, N. Y.*

How to Make Your Advertising HELP Our War Effort

Advertising Has to CHANGE To Work TODAY!

FREE MANUAL, NOW READY, SHOWS HOW

90 PAGES OF PRACTICAL HELP

Demonstrates, by example, how your advertising, too, can help fight the war; help customers; help build a sound foundation for future business.

Want FACTS? No chronicle of theories and opinions, this. "A Guide To Effective War-Time Advertising" is a factual report based upon the testimony of business leaders who have found ways to make their advertising *helpful* to their customers and prospects at a time when help is so desperately needed. It shows, too, how "oversold" companies now use "service advertising"; how they do as the business paper editors do . . . *use their space to transmit important information from where it is to where it is needed.*

Examples of Sound, Shirt-sleeve Advertising. After you read this "Guide," you will have a new concept of what advertising can do to help America's war effort and to help your company solve its customer-relations problems, present and future. *And you will know what good "institutional" advertising is!* The Guide features advertisements that show some recognition of the conditions which today have *increased* rather than lessened the need for making business paper advertising *useful, informative* and *specific.*

This Guide, while comprehensive in itself, is only our introduction to a collection of case studies that will constitute a veritable WAR ALBUM. Send for it now and you'll receive additional up-to-the-minute case studies, free, as fast as they're produced.

We Have to Use EVERYTHING WE'VE GOT To Win This War!

Good business papers are multi-purpose carriers that can convey important messages quickly, accurately, economically, to special groups of men with kindred war-time problems. America, the world's greatest user of these vehicles of business communication, has a powerful tool to use against the Axis. By making the best possible use of business papers, now, we can strike a blow that will be felt across both oceans.

"A Guide To Effective War-Time Advertising" will help you do this. One copy is yours for the asking . . . if you'll ask before they're all gone.

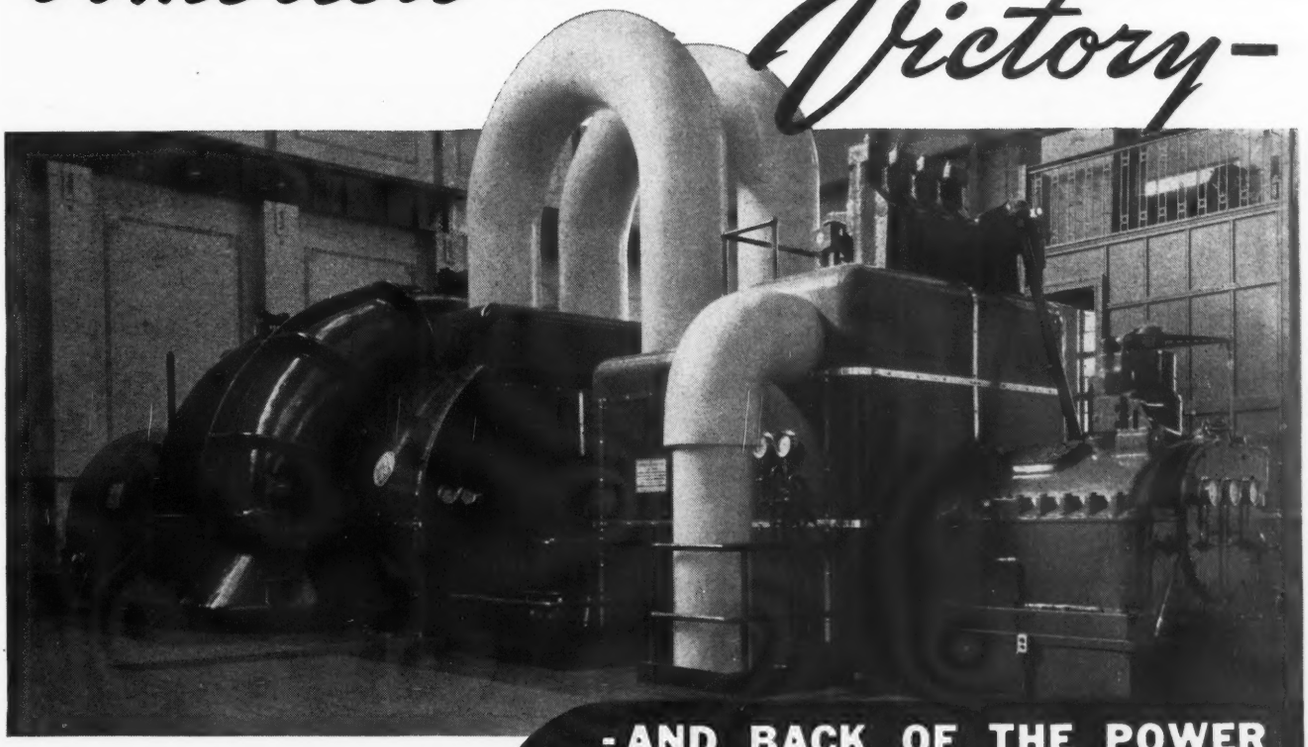
FREE

THE ASSOCIATED BUSINESS PAPERS (ABP)
Dept. M
369 Lexington Avenue, New York City

Please send, without obligation, my free copy of "A Guide To Effective War-Time Advertising."

NAME .....
POSITION .....
COMPANY .....
STREET .....
CITY & STATE .....

America HAS THE POWER FOR *Victory*—



-AND BACK OF THE POWER ARE *Carey* INSULATIONS

Making Power Economical

NOT all the victories are won at the battlefront. Back of the planes, tanks and ships that go out to meet the enemy is the power that makes them possible. And back of this power are the Carey Insulations that control temperatures and stop heat waste at its source.

Through vast experience and years of intensive research, CAREY has won notable victories over waste in power production—has made insulations so efficient that normally they repay their cost through fuel savings, in a fraction of a year—has made them so tough and durable that their maintenance cost is practically nil.

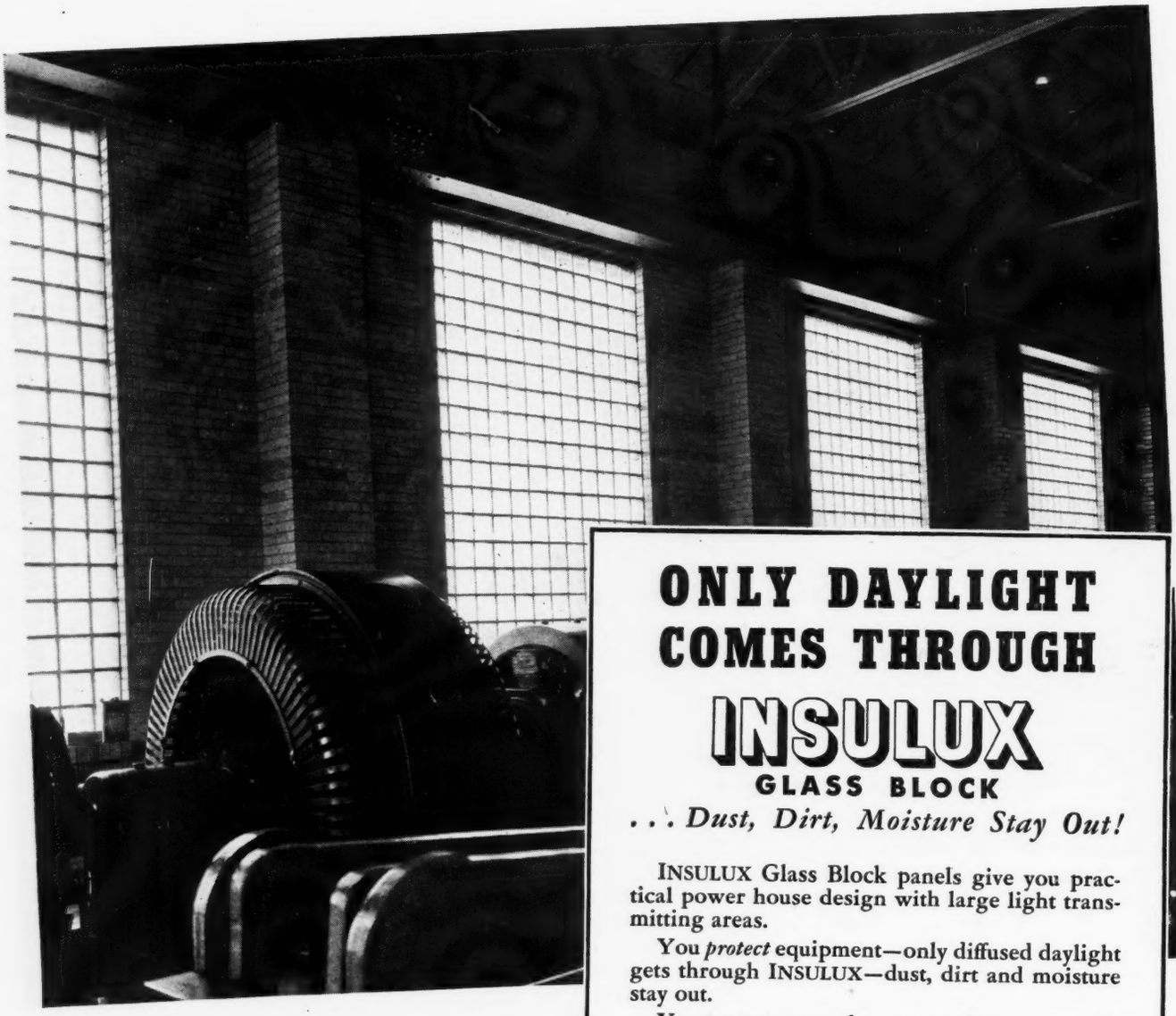
In hundreds of plants throughout the nation, Carey Heat Insulations are contributing to the economical production of power. There is no substitute for Carey quality and dependability. Make sure of maximum results by using these time-proved products. A nationwide organization is ready to serve you. For details, address Dept. 16.

THE PHILIP CAREY MFG. CO.

Dependable Products Since 1873

Lockland, Cincinnati, Ohio

In Canada: The Philip Carey Company, Ltd.
Office and Factory: Lennoxville, P. Q.



ONLY DAYLIGHT COMES THROUGH

INSULUX

GLASS BLOCK

. . . Dust, Dirt, Moisture Stay Out!

INSULUX Glass Block panels give you practical power house design with large light transmitting areas.

You *protect* equipment—only diffused daylight gets through INSULUX—dust, dirt and moisture stay out.

You *protect* power for war production—sturdy INSULUX panels prevent easy entrance by saboteurs. They are noncombustible.

You *save* on maintenance—INSULUX is easy to clean, needs no painting.

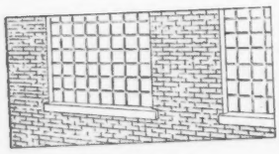
You *save* critical materials—only INSULUX Glass Block and mortar are used in panels under 50 feet square (10 feet maximum width); in larger areas little metal is needed.

A new tested technique for construction, maintenance, or rehabilitation with INSULUX is fully described in the free booklet, "Alternate Construction Details." Send coupon below today for your copy.

Here's the perfect light-transmitting material for *your* power plant.

Construct a chase in masonry walls to receive glass block panel. No metal or wood frames required.

Any competent mason can install INSULUX panels. The corrugated bearing edges on INSULUX bite into mortar, give block a firmer grip.



Finished panel transmits diffused daylight, protects vital equipment, pays dividends on reduced maintenance.

OWENS-ILLINOIS GLASS COMPANY, INSULUX Products Division, Department 54, Ohio Building, Toledo, Ohio

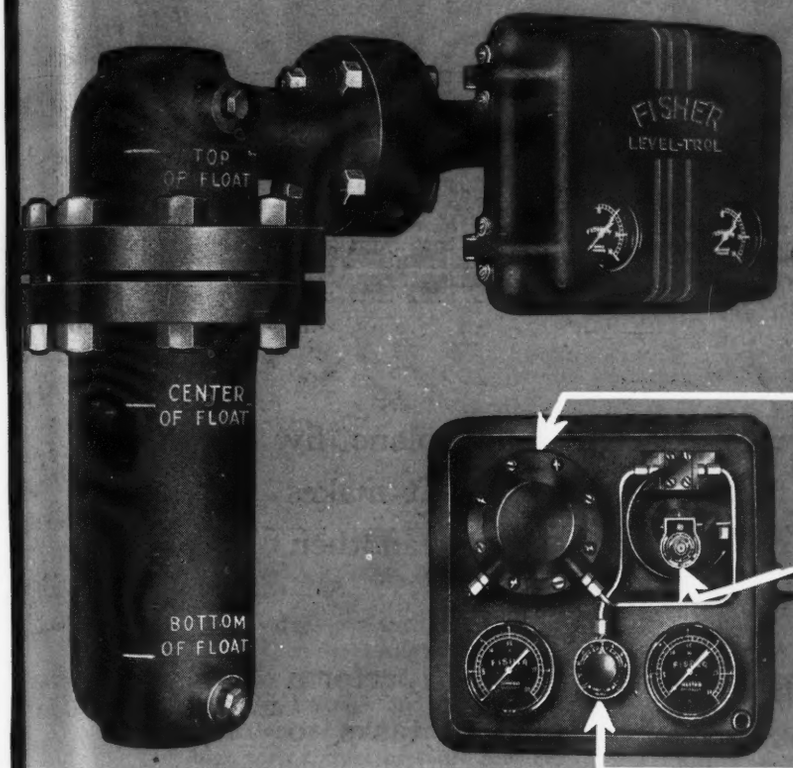
Please send me, without obligation, your free book entitled, "Alternate Construction Details" showing how to save metal and aid war construction and full information on INSULUX Glass Block.

*Name*_____

*Address*_____

*City*_____ *State*_____

FISHER ANNOUNCES an Improved DISPLACEMENT TYPE LEVEL-TROL



Type 2400-248 LEVEL-TROL with 600 lb. cast steel float cage screwed equalizing connections — 14" float.

FEATURING

Greater Sensitivity . . . Speed of Action . . . Freedom from Service Trouble . . . Ease of Adjustment

Available in Float Cage or Internal Float Type Construction for Handling all Liquids, at all Pressures, Temperatures, Specific Gravities.

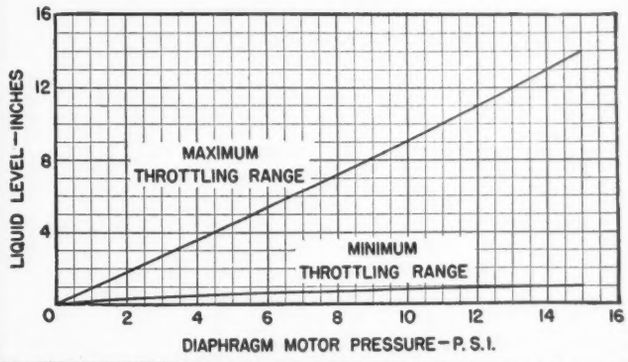
EXTREME SENSITIVITY . . Accurately engineered to insure extremely sensitive level control — No measurable lag. Pilot is 100% pneumatic in operation — All linkage, pivot points and other sources of friction eliminated. Necessary operating power reduced to an absolute minimum.

Pilot Relay Speeds Action of Diaphragm Valve in Response to Level Change. Intermittent bleed relay, greatly magnifies pressure and volume of air passing through primary orifice system. Response of diaphragm valve to level change is extremely rapid.

Level Position Adjustment Permits Operator to Control Level at Any Desired Point within Length of Float. Adjustment is easily made by turning the knob in accordance with the arrow on adjustment dial.

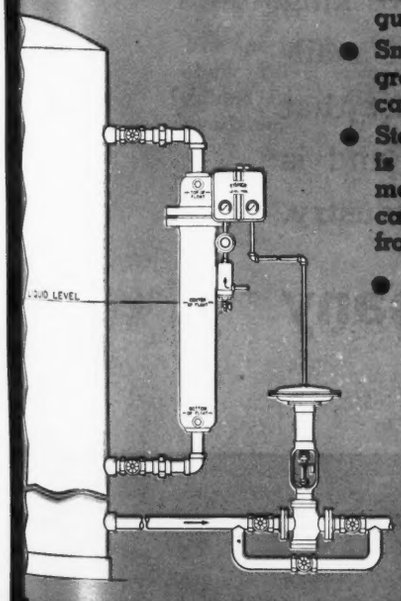
Throttling Range Adjustment Makes Level-Trol Suitable for Wide Variety of Applications. Makes it possible to vary amount of level change necessary to fully stroke diaphragm valve. Minimum level change may be as little as ½" and the maximum equal to length of float. Adjustment knob provided with calibrated dial — easily operated — readily accessible.

Straight Line Action . . Curves, below, illustrate how pressure changes on diaphragm as level changes throttling range setting in the two extreme positions.



New Design Features

- Inconel torque tube construction eliminates stuffing box packing, and lubricator—is supported by stainless steel knife edge bearing, free from gumming and sticking.
- Small rotary shaft turns on precision ground ball bearing inside the pilot case.
- Stainless or plated carbon steel float is freely suspended, free from lost motion and entirely free from friction causing guides. Available in lengths from 14" to 120".
- High-tensile iron and steel cages for pressures 125 lbs. to 2500 lbs. A.S.A. ratings, are furnished with 1½" and 2" screwed equalizing connections or with 2" flanged connections.



Typical Level-Trol installation for maintaining liquid level by controlling flow from the vessel.

FIVE LEVEL-TROL TYPES

Fisher Level-Trols are available in two float cage types and three internal float types for flange mounting on top or side of vessel with float sizes to meet all service conditions. All types can be furnished for pressures 125 lbs. to 2500 lbs., A.S.A. Ratings.

Write for New Descriptive Bulletin F-1.

Other Level-Trol Pilot Features

REVERSIBILITY . . Pilots may be either reverse or direct acting as specified or can be easily reversed in the field.

BLEED . . Screened elbow fitting is provided for bleed vent. Bleed may also be piped away if desired.

CASE . . High-tensile iron pilot case is weather proof and gas tight. The hinged door is gasket sealed. Supply and diaphragm pressure tappings are screened.

INSTRUCTION PLATE . . Metal instruction plate, on inside of pilot door gives service ratings of cage, dimensions and collapsing pressure of float, and adjustment instructions.

AUXILIARY PARTS . . All Level-Trols furnished with operating medium regulator and filter.

FISHER GOVERNOR COMPANY

• 420 FISHER BUILDING •

MARSHALLTOWN, IOWA

Design

Design is what makes one airplane fly higher and faster than another. It makes one gun shoot farther and straighter than another. One tank hit harder than another.

Design is what makes Powell Valves perform better and last longer in the industrial tasks to which they are assigned. It is exemplified in the vast assortment of special valves built to do special jobs that make up the Powell Line. It is carried on by a corps of highly trained experts working with the most modern technical equipment available. It will continue to represent the part that Powell has played for almost a century and is still to play in the forward march of Industry.

The Wm. Powell Company
Cincinnati, Ohio

POWELL

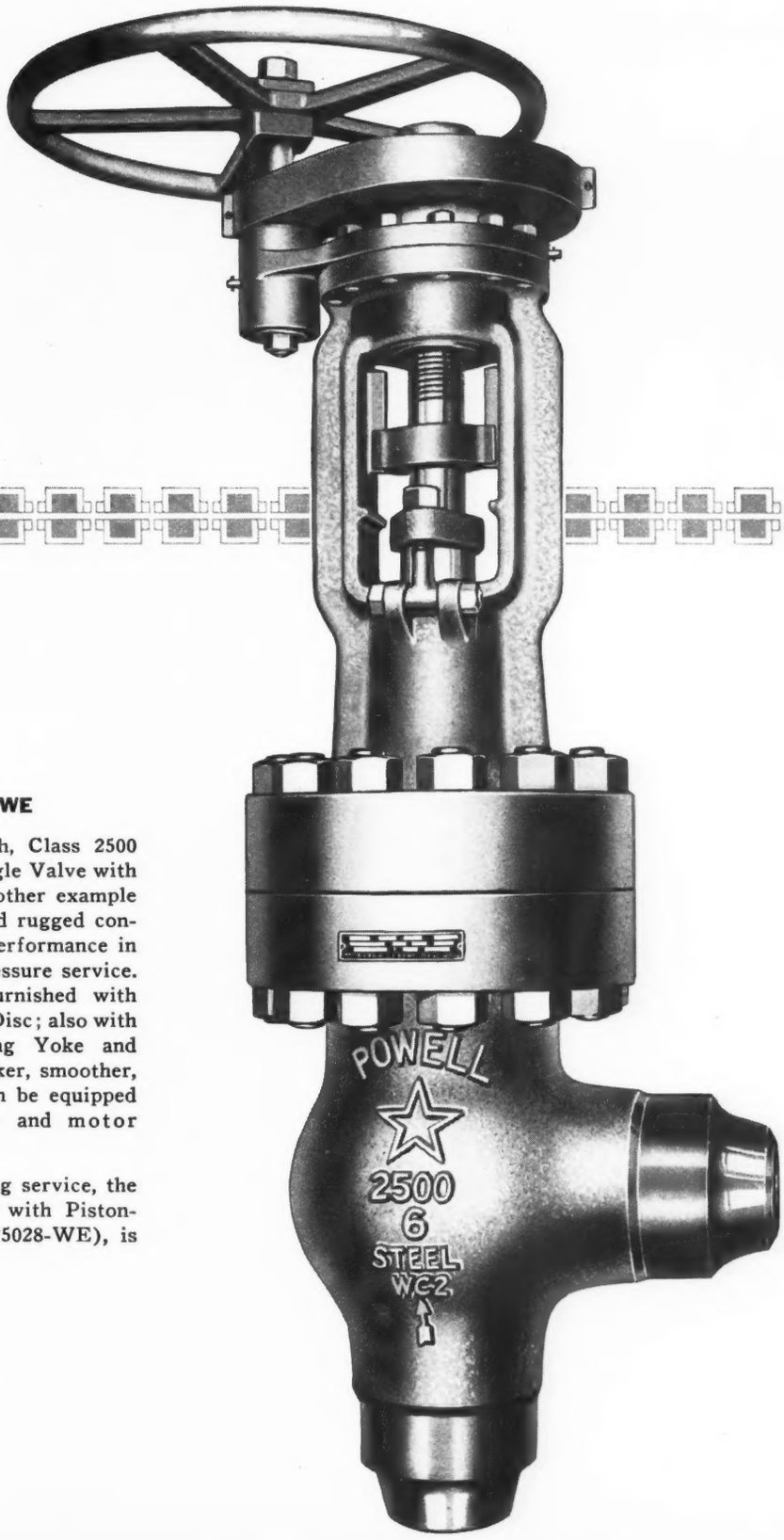


Fig. 25033-WE

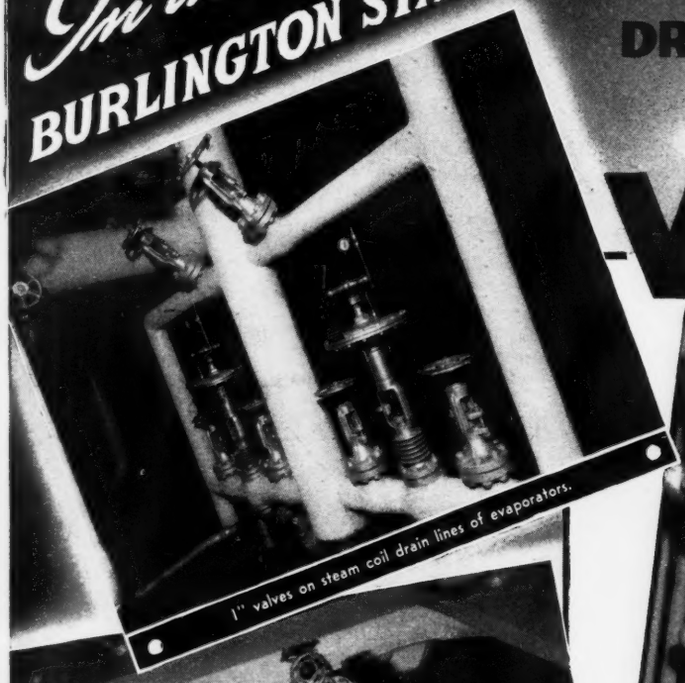
This valve—a 6-inch, Class 2500 pound Cast Steel Angle Valve with welding ends—is another example of Powell *design* and rugged construction for peak performance in high temperature-pressure service. It is regularly furnished with Semi-cone Seat and Disc; also with Anti-friction Bearing Yoke and Spur Gears for quicker, smoother, easier operation. Can be equipped with bevel gears, and motor operators.

For special throttling service, the above valve, except with Piston-guided Disc (Fig. 25028-WE), is available.

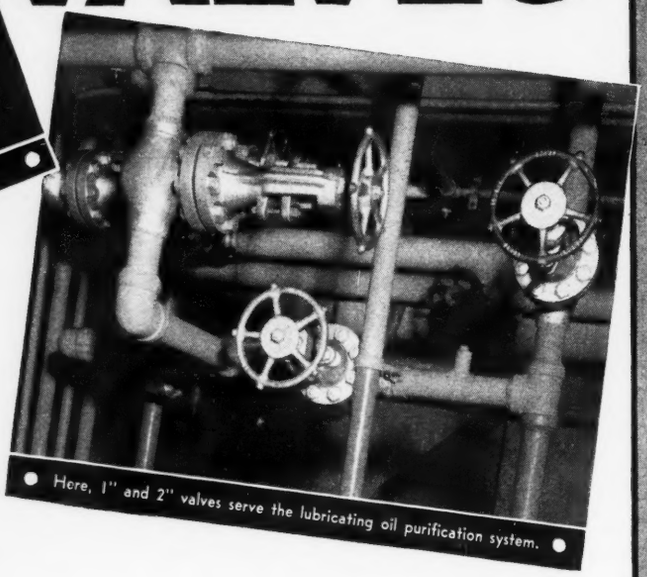
VALVES

In the line at BURLINGTON STATION

Vogt DROP FORGED STEEL VALVES

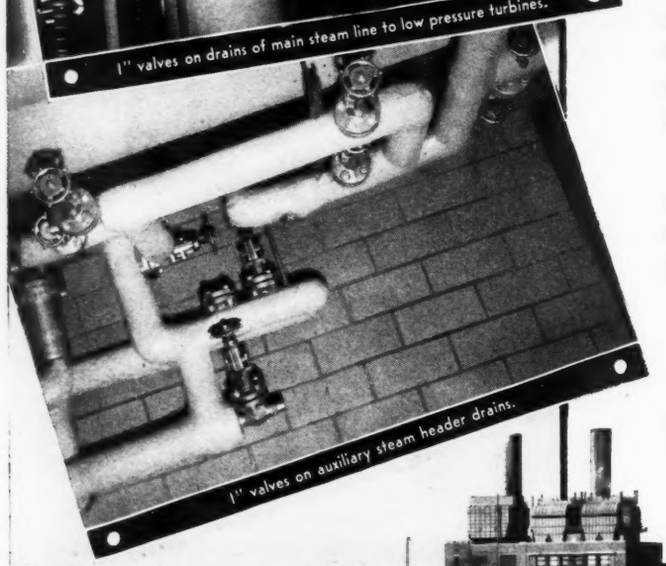


1" valves on steam coil drain lines of evaporators.



Here, 1" and 2" valves serve the lubricating oil purification system.

1" valves on drains of main steam line to low pressure turbines.



1" valves on auxiliary steam header drains.

Unit No. 5 at the Burlington Generating Station of the Public Service Electric and Gas Company has recently been placed in service. It consists of two 550,000 lb.-per-hour boilers which supply steam at 1,250 lb. and 950 deg. F., a 125,000-kw. condensing turbine-generator operating at 3,600 rpm., and the necessary auxiliary equipment.

Vogt *drop forged steel* socket weld end valves, as illustrated here, play an important part in the smooth, dependable functioning of this modern power plant.

Catalog F-8 sent upon request.

●

HENRY VOGT MACHINE COMPANY

Incorporated

LOUISVILLE, KENTUCKY

Branch Offices: New York - Philadelphia - Cleveland - Chicago - Dallas

General view of Burlington Generating Station of the Public Service Electric & Gas Company.

Get *33% to 100%* increased output from your present boilers--

with a minimum of new capital investment— *50 to 70 day* delivery!

● If you want more steam—quickly—investigate Stowe Stokers. Find out how easily they can be installed under your present boilers in place of your older type stokers. By increasing the output of your present boilers, Stowe Stokers will give you more steam—not next year—but within the next few weeks. They have greatly increased the steam outputs of other plants. Let us show you what they can do for you.

Typical examples of the increased steam outputs Stowe Stokers have made possible include: A large automobile manufacturer who jumped his boiler output from 200% to 400% of rating when he put in a Stowe Stoker—and has bought 7 more since . . . and a large utility that jumped the capacity of a unit from 75,000 to 135,000 lbs. of steam with a Stowe Stoker—and has bought 2 more since. Other installations in the mining, quarrying, leather, rubber, textile, tobacco, and salt industries—to name only a few—all are producing the desired results.

Get more complete details today. Send for our completely illustrated catalog—or a Stowe Stoker engineer to talk over and show you how a Stowe Stoker will get you more steam—quick. There's no obligation either way. Write, telephone or telegraph to:—

THE JOHNSTON & JENNINGS CO.

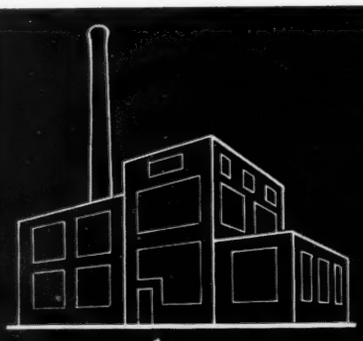
DETROIT — 878 Addison Road, CLEVELAND, OHIO — CHICAGO

Engineering and Sales Representatives in
New York • Pittsburgh • Kansas City • St. Louis

STOWE STOKERS

★ ★ GIVE YOU MORE STEAM FROM LESS COAL ★ ★

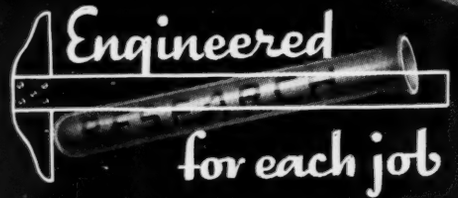
THREE STEPS TO *higher* POWER PLANT *Efficiency*



1 RESISTANCE TO HIGH TEMPERATURES is one feature of Crystolon Brick—one reason why they assure long, trouble-free service.

2 RESISTANCE TO SLAG ACTION of molten ash—silicon carbide brick are so dense that molten slag will not take hold—they are particularly resistant to the erosive action of slag.

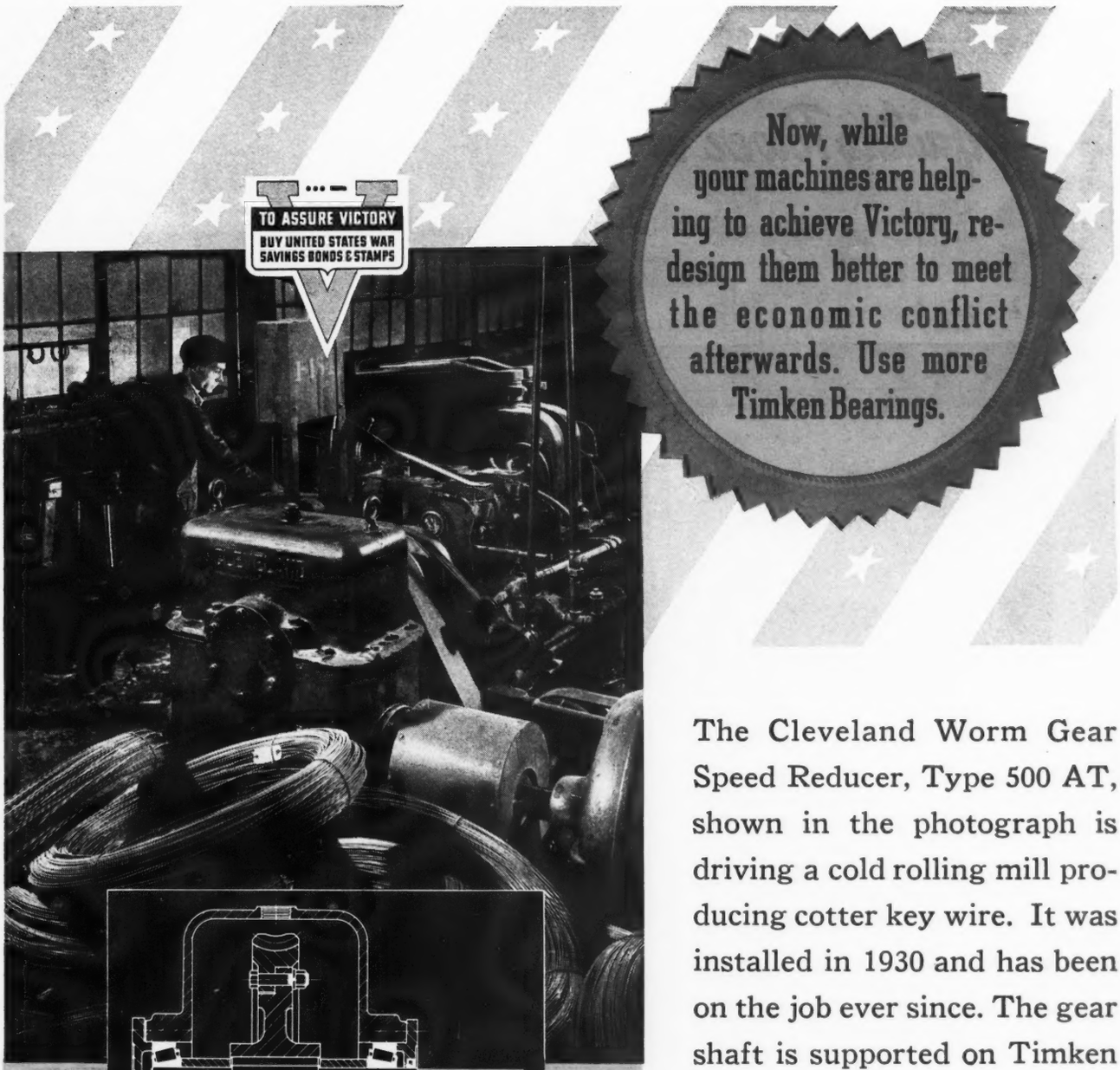
3 RESISTANCE TO CLINKER ADHESION and ABRASION. Crystolon Brick cut down clinker adhesion—clinkers can be "barred" loose without damage to the brick. They are resistant to abrasion—to the moving fire bed of a stoker-fired furnace.



Engineered for each job

NORTON COMPANY
Worcester, Mass

NORTON ELECTRIC FURNACE FUSED REFRACTORIES



Now, while your machines are helping to achieve Victory, redesign them better to meet the economic conflict afterwards. Use more Timken Bearings.

Application of Timken Bearings on the gear shaft of the Cleveland Worm Gear Speed Reducer.

The Cleveland Worm Gear Speed Reducer, Type 500 AT, shown in the photograph is driving a cold rolling mill producing cotter key wire. It was installed in 1930 and has been on the job ever since. The gear shaft is supported on Timken Tapered Roller Bearings and no bearing has had to be replaced since the reducer went into operation. That's *service!*

The more Timken Bearings there are in the equipment you make or use, the better it will function and the less it will cost for operation and maintenance.

TIMKEN

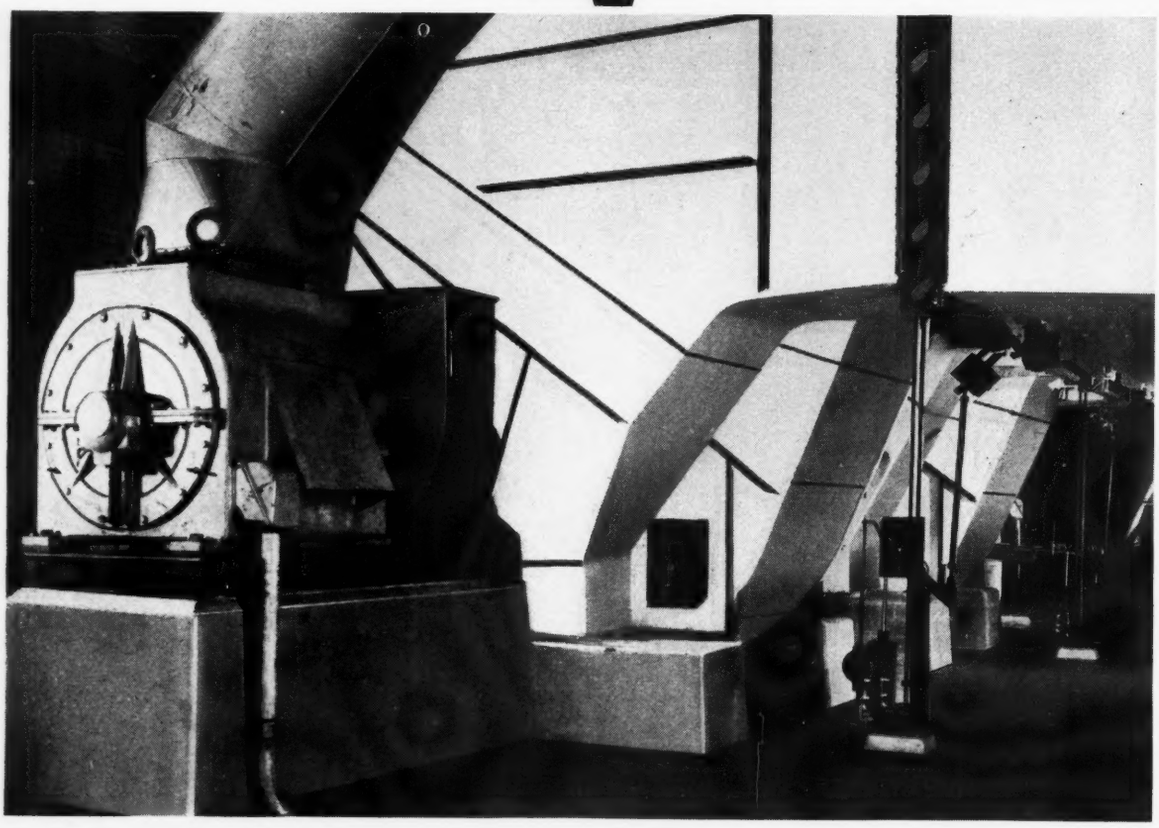
TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Unfailing Power is **VITAL TO VICTORY**



BUFFALO FANS MATCH TODAY'S SEVERE DEMANDS

Yes, these day's of unprecedented power demands give Buffalo Mechanical Draft Fans a chance to prove their mettle. And they're doing it, day and night, as war production surges forward.

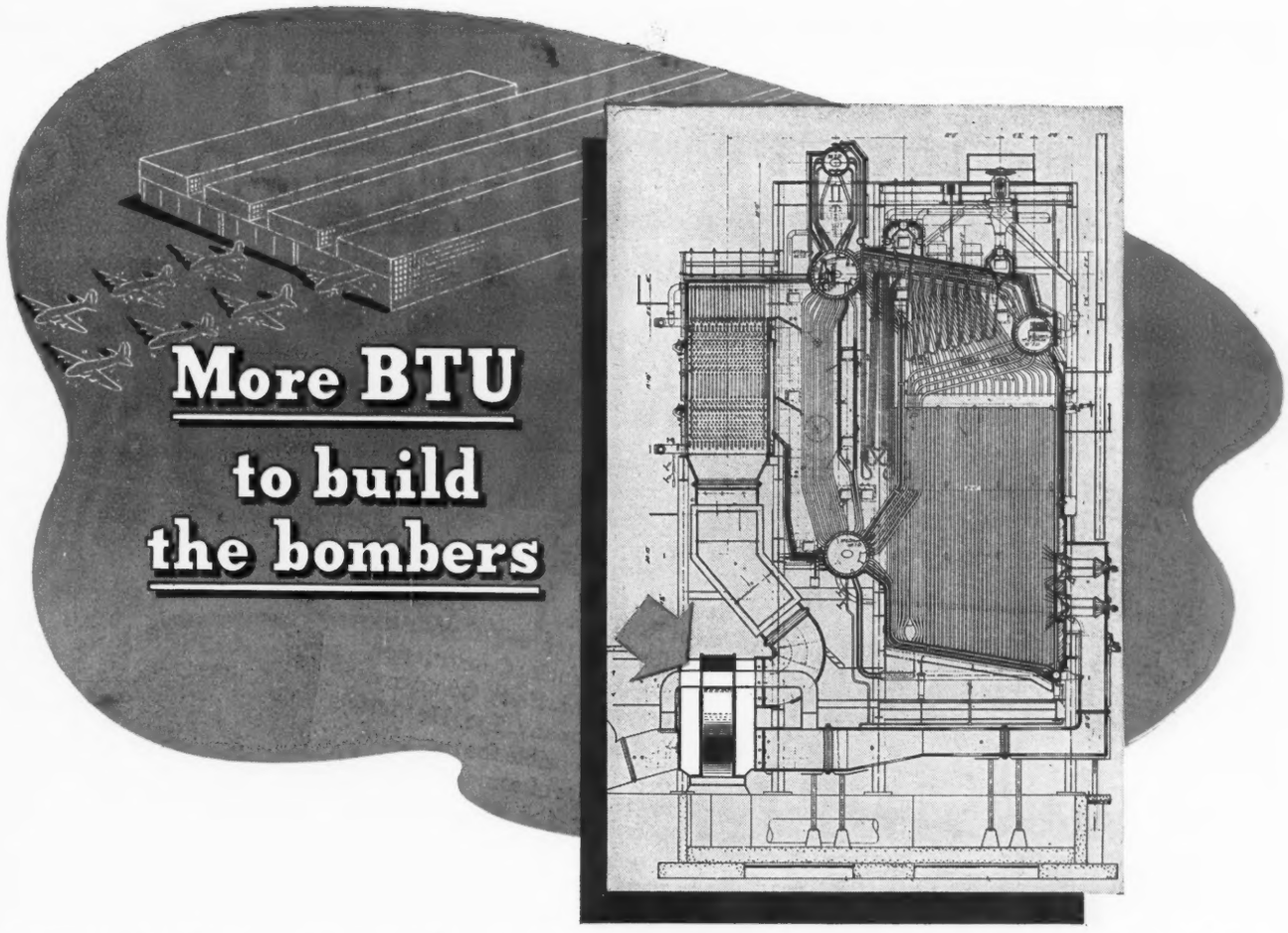
Buffalo Fans are built with an extra margin of stamina—the result of practical engineering plus skillful craftsmanship down to the smallest detail. Yes, Buffalo Fans can "take it"—and keep right on taking it for years of unfailing service.

BUFFALO FORGE COMPANY

488 Broadway, Buffalo, N. Y.

Branch Engineering Offices in Principal Cities — **Canadian Blower & Forge Co., Ltd., Kitchener, Ont.**

"Buffalo" **MECHANICAL DRAFT FANS**



Increased Power Demands of Bomber-Building Area Will Be Met With Ljungstrom-Equipped Steam Generating Units . . . . . .

To meet the increasing industrial and domestic load of an area of vital importance to America's war plans, two of these high-efficiency steam generators, each with a peak capacity of 675,000 lb. steam per hr., are being installed. Each boiler will be equipped with two Ljungstrom Air Preheaters, having 66,300 sq. ft. of heating surface per boiler. Gases will enter the preheaters at 745 deg. F., leave at 388 deg., heating the combustion air to 550 deg. A by-pass arrangement on the preheaters will give flexible air temperature control at any operating rate.

* * * * *

Today's power plant designs give new importance to *CONSERVATION* . . . conservation of *fuel,* by means of high operating efficiency . . . conservation of *steel and other materials,* by equipment which gives the greatest heat recovery per pound of steel. Ljungstrom Air Preheaters aid on both counts:

(1) Preheated air improves combustion, raises the capacity of the furnace, increases the overall heat recovery.

(2) Ljungstrom Air Preheaters are only about *one-third* the size and weight of other types giving equal heat recovery. One inch in height of Ljungstrom heating surface equals one foot in height of tubular surface of practical size. The saving in preheater steel is augmented by savings in foundation materials.

All the major builders of high capacity power plants have included Ljungstrom Air Preheaters on recent jobs. The proportion of such units being so equipped is increasing all the time.

A new booklet, "Another Kind of Air Power with a Wartime Job to Do", gives facts and figures on the savings made, as determined from actual jobs now in service. Write for a copy.

THE

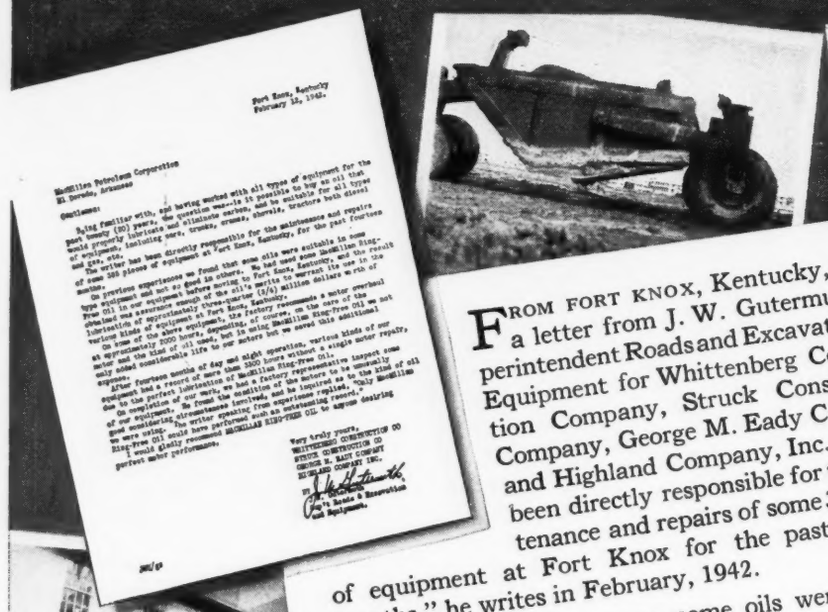
AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

"An outstanding record" on 385 pieces of equipment

CARS • TRUCKS • CRANES • SHOVELS • DIESEL AND GAS TRACTORS



Fort Knox, Kentucky
February 16, 1942.

Macmillan Petroleum Corporation
El Dorado, Arkansas

Gentlemen:

Being familiar with, and having worked with all types of equipment for the past twenty (20) years, the question was—is it possible to buy an oil that would properly lubricate and eliminate carbon, and be suitable for all types of equipment, including cars, trucks, cranes, shovels, tractors both diesel and gas, etc.

The writer has been directly responsible for the maintenance and repairs of some 385 pieces of equipment at Fort Knox, Kentucky, for the past fourteen months.

In previous experience we found that some oils were suitable in some type equipment and not so good in others. We had used some Macmillan Ring-Free Oil in our equipment before moving to Fort Knox, Kentucky, and the result obtained was reassurance enough of the oil's qualities to warrant its use in the various kinds of equipment at Fort Knox, Kentucky.

In previous jobs, we have found that some oils were good in some types of equipment and not so good in others. His experience with Macmillan RING-FREE was reason enough for him to use it on $750,000 worth of equipment at Fort Knox.

On some of this equipment, the factory recommends a motor overhaul at approximately 2,000 hours. But—

"After fourteen months of day and night operation," continues Mr. Gutermuth, "various kinds of our equipment had a record of more than 3,300 hours without a single motor repair, due to the perfect lubrication of Macmillan RING-FREE Oil."

When a factory representative inquired what oil had been used, Mr. Gutermuth replied:

"Only Macmillan RING-FREE Oil could have performed such an outstanding record."

Whatever your equipment may be, write us, so that Macmillan RING-FREE can do for you what it is doing for others.

• • •

MACMILLAN
PETROLEUM
CORPORATION

50 West 50th St., New York
624 S. Michigan Ave., Chicago
530 West 6th St., Los Angeles

MACMILLAN
RING-FREE
MOTOR OIL

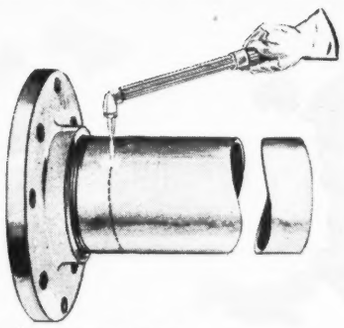
REG. U.S. PATENT OFFICE

Copyright 1942 by
Macmillan Petroleum Corporation

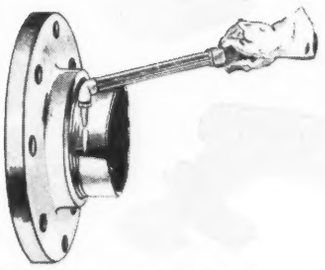
SALVAGE THAT PIPE FLANGE!

Today reclaimable materials *must* be reclaimed and restored to use. Screwed flanges and other types of screwed fittings can be removed from pipe. If they can't be unscrewed, cut off the pipe within a few inches of the fitting or flange. Split the remaining pipe; then collapse it by hammer blows, vise, pneumatic hammer or press to free it from the flange or fitting.

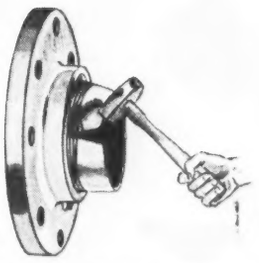
Thoroughly clean the threads of flanges and fittings thus reclaimed before reusing. Use a fine wire brush. Some fitting threads may not have been in contact with the threads of the pipe, resulting in the accumulation of corrosion or foreign matter which can be removed with hand tools.



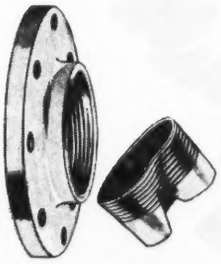
1 Cut pipe near flange.



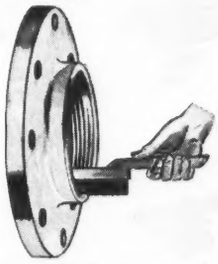
2 Cut "V" shaped notch in pipe remaining in flange.



3 Collapse pipe with hammer blows, as shown.



4 Pipe falls out of flange leaving flange threads unharmed.



5 Clean threads thoroughly.

6 O.K. for reuse.

WALWORTH 1842 1942 VALVES AND FITTINGS 100TH. ANNIVERSARY

THIS IS OUR CENTENNIAL YEAR

This advertisement is one of a series prepared by Walworth in cooperation with the national program of Salvage, Simplification, Specification and Substitution. It is offered in a sincere effort to be helpful to users of valves, fittings, flanges and pipe.

We would like you to remember that this is our 100th Anniversary year and that Walworth has *continuously* manufactured valves and fittings for a century!

ANOTHER PIECE OF VITAL WAR MATERIAL SALVAGED

WALWORTH

WALWORTH COMPANY
60 EAST 42nd STREET, NEW YORK

VALVES FITTINGS and TOOLS
Backed by 100 Years' Service

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

On time again . . . over Tokyo and Berlin

NOT in a frenzied joy in destruction, or an unholy lust for blood; but in the solemn and angry conviction that by the cleansing of two areas of the world's surface, and all they stand for and all the thoughts that breed there, we can build a better world; in this spirit must our nation's will, and the sinews of our industrial strength, and the striking power of our fighting arm be directed to our task. Together we must labor toward this goal . . . *for from those bomb bays fall the seeds of peace!*

In industrial warfare, water is a weapon. If there are any problems concerning its proper treatment in your plant, Graver engineers, with years of experience behind them, are at your disposal—without obligation.

WRITE GRAVER TODAY

GRAVER

GRAVER TANK & MFG. CO., INC.

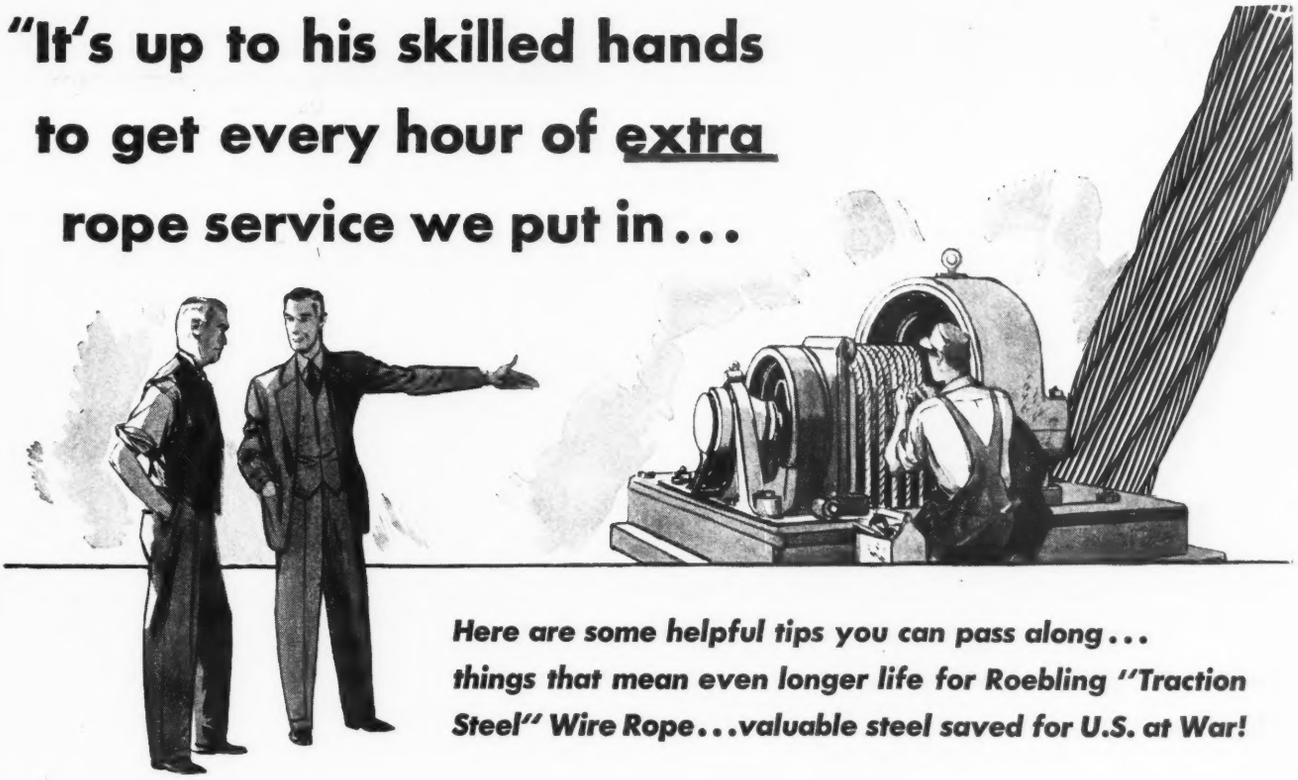
NEW YORK
CATASAUQUA, PA.

4809-7 TOD AVE.
EAST CHICAGO, IND.,
CABLE ADDRESS — GRATANK

CHICAGO
TULSA

42-36-W

"It's up to his skilled hands to get every hour of extra rope service we put in..."



Here are some helpful tips you can pass along... things that mean even longer life for Roebling "Traction Steel" Wire Rope...valuable steel saved for U.S. at War!

Lesson One:—a hammer weighing only a few pounds can produce a blow having a force of a couple of tons. The load on a wire rope is like a hammer—striking a blow on the rope whenever you start the load too quickly.

And it's the same when the rope is going the other way. When even a light load is stopped suddenly while being lowered, the rope is subjected to a much greater strain than the equipment could ever apply to it in hoisting. So *check regularly for smooth deceleration.* Brakes should be applied smoothly and uniformly, and at the slightest sign of "grab" should be eased off. Brake your load over a longer period and your rope will last over a longer period.

In general, sudden stresses can be said to remove from the rope the very elasticity that is put in to absorb normal impact, while careful handling will preserve the rope's elasticity and keep it in condition to deliver long life.

Of course, the way a machine is run always affects its general maintenance. It's a well-known fact that some people are harder on machinery than others. An operator can push a machine (and a rope) just so far—beyond that, the punishment takes its toll of both the machine and the rope. But in these days when rope steel is vital to the war effort, *wire rope must not be abused.*

Lesson Two:—a team of horses must pull together if maximum work is to be done. Likewise, with elevator ropes, the tension on all ropes must be equalized so that each rope carries its share of the load. Ropes that are slack should be adjusted at the socket end or they will not do their share of the work and will throw a greater burden on those ropes that are taut. The result is that the life of the entire set is shortened. *Be sure that rope tensions are equalized* and maintained in this condition by checking at regular intervals.

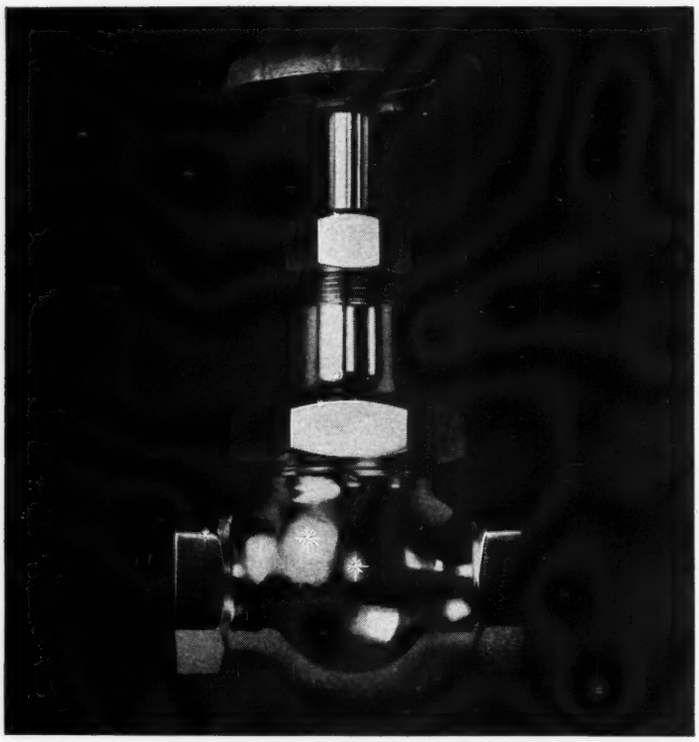
Roebling "Traction Steel" Wire Rope is made to deliver a long lifetime of service—it has built a reputation for just that, wherever wire rope has a routine or unusual job to do. Made in 6 x 19 and 8 x 19 constructions."

JR ROEBLING

More ways to help you conserve wire rope coming in this space next month.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

ROEBLING
"Traction Steel"
ELEVATOR ROPE



★
READING-PRATT & CADY
VALVES FOR
POWER PLANTS
★

LOYALTY IS NOT TAGGED WITH THE PRICE OF BRASS

These are the UNITED STATES.

Of course we differ among ourselves. But the world has learned, again, that these are family matters—marks of energy that, upon attack, crystallize to dynamic unity.

Men who battled the devil with words from the pulpit now fight him with machine guns from the ranks. Fingers that were trained for gossamer express their loyalty on the assembly lines of huge bombers that will blast America's enemies from security.

And it is no less indication of the spirit today that, as forge and press thunder their answer to the call to war, men in industry cease to demand that priority deliver *anything* for peace that tools can fashion into arms. In that same spirit, too, men no longer clamor that vitals such as nickel, chromium, and brass be delivered for civilian use.

Certainly, substitutes for products of proved economy work hardship and add to the cost of industry. And that may be particularly true when applied to valves.

But, Americans already prove that they don't tag their loyalty with the price of Brass!

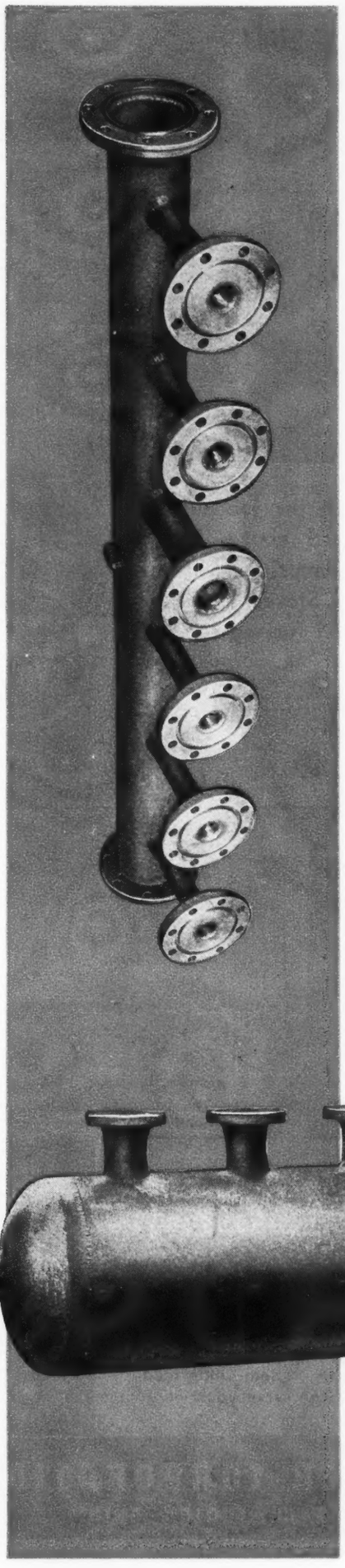
READING-PRATT & CADY

MANUFACTURERS OF (R) *AND* (P&C CO) *VALVES AND FITTINGS*

Reading, Pa., Atlanta, Boston, Chicago, Houston,
Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

ACCO

A Division of AMERICAN CHAIN & CABLE COMPANY, INC. Bridgeport, Conn.



IMPORTANT

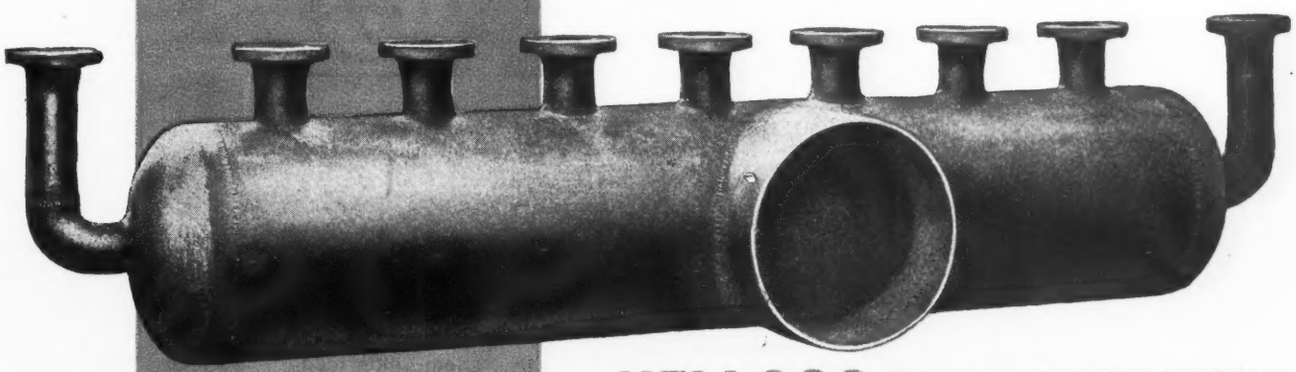
6 IN. OR 30 IN.

THE QUALITY IS THE SAME

Kellogg prefabricated piping assemblies, simple as those shown here, or as intricate as required for the most individual conditions — ranging in pressure from 200 to 2200 pounds—are installed in various power plants in this country.

Accurately prefabricated and thoroughly tested in the Kellogg shops these assemblies are shipped ready to connect, saving time and money on the job.

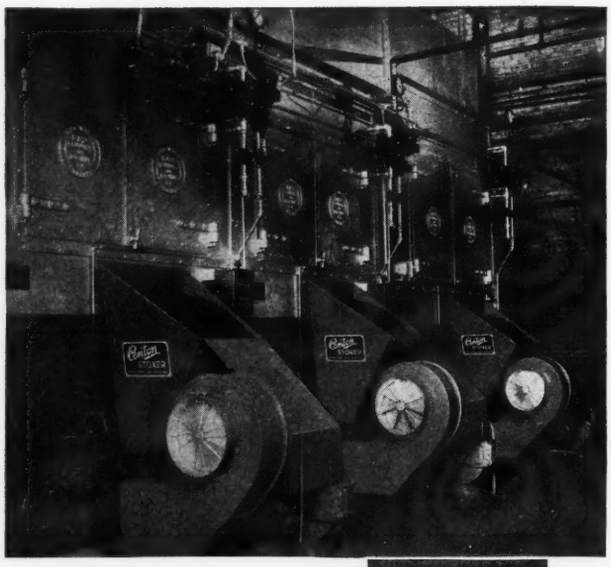
In fact, consulting engineers, operators of central stations, industrial and marine power plants, find that pinning the responsibility for piping on The M. W. Kellogg Company is the most satisfactory solution to their problems.



KELLOGG **THE M. W. KELLOGG COMPANY**
JERSEY CITY, N.J. · 225 BROADWAY, N.Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND · TULSA: PHILTOWER BLDG.

"Masterflex" Prefabricated Piping Systems · **"Masterweld"** pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units · **JUIK Processes** for Lubricating Oil Plants. Plastic Refractories · Radial Brick Chimneys.

CANTON STOKERS *on the job...*

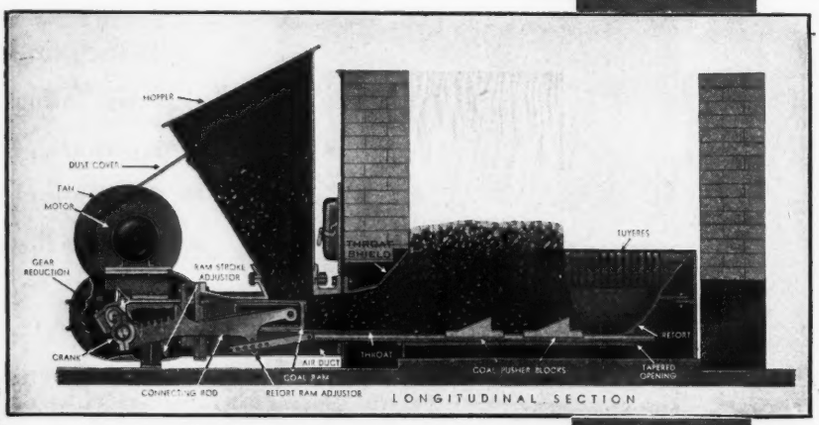


In plants, both large and small, CANTON Stokers are on the job saving TIME AND FUEL Dollars—as in the installation pictured above. These are Heavy Duty Lo-Set Ramfeed Units with Side Ash Dumps, Ash Spray Pipes and Combustion Control Equipment. CANTON Stokers embody every proved advantage that 32 years experience building fuel equipment can provide. Below are listed other Models available for all purposes.

Vulcan Ramfeed	up to 850 H.P.
Lo-Set Ramfeed	up to 450 H.P.
DeLuxe Wormfeed	up to 175 H.P.
Standard Wormfeed	up to 125 H.P.

CANTON STOKER

. . . are Guaranteed to DO the Job!



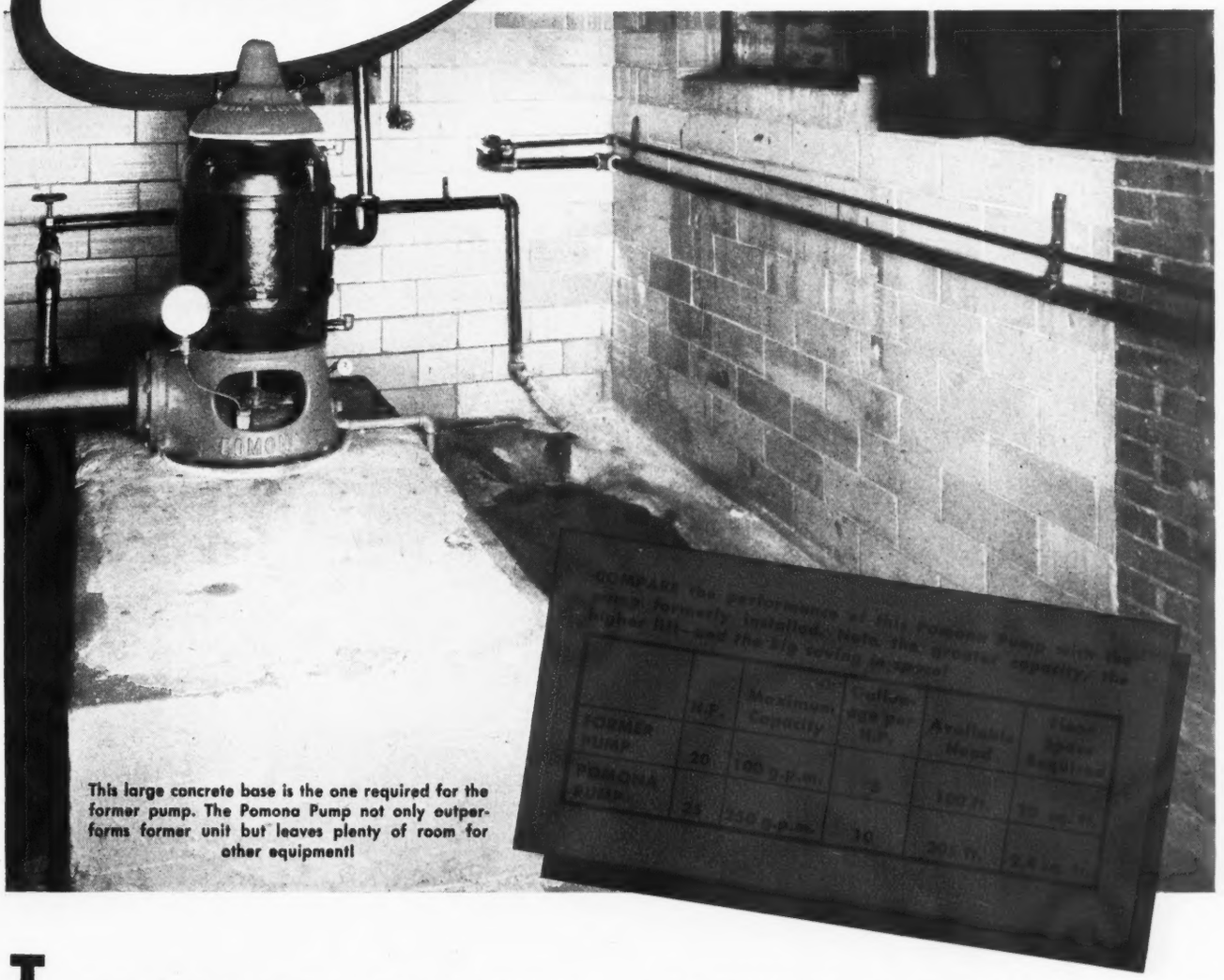
. . . a fact that is a definite money-saving advantage. With such a guarantee certificate, CANTON STOKERS will do the job! There's a satisfied CANTON user near you . . . ask him. Or, if you want action, write, wire or phone us today . . . let our engineers recommend the CANTON STOKER best suited for your job . . . whether a Hand Stoker, Overfeed, Worm or Ram Underfeed . . . CANTON can serve you!

CANTON STOKER CORPORATION
ANDREW PLACE, S. W., CANTON, OHIO

THIS *Pomona Pump* DOUBLED the capacity . . . DOUBLED the available head . . . in one-eighth the space!

If you installed a pump that gave you TWICE as much water per horsepower as your former equipment, you'd feel you had made a mighty good investment. But if it not only delivered *twice* as much water, but lifted it *twice* as high . . . and required less than ⅛th the floor space—then you'd KNOW you had something really outstanding—*the kind of outstanding performance that has made Pomonas famous wherever water is pumped!*

And that's exactly the story on this Pomona Pump installation. Read about it . . .



This large concrete base is the one required for the former pump. The Pomona Pump not only outperforms former unit but leaves plenty of room for other equipment!

THE large Ohio plant* where world-famous Leiderkranz Cheese is made replaced their former 20 hp. water pumping equipment with a Pomona Vertical Turbine. The former pump required approximately 20 square feet of floor space . . . had a maximum capacity of 100 gpm . . . and would lift this water only 100 feet.

In contrast, the Pomona—a 25 hp. installation—is delivering 250 gpm, lifting it 205 feet—and occupies less than 2½ sq. feet. In other words, it's giving *double* the gallonage per horsepower . . . lifting it *more than double* the height . . . *and occupies less than ⅛th the floor space required by the* former pump!

Performance like that tells its own story!

WHAT ABOUT YOUR PLANT?

No matter where you pump water in your plant—or how large or small your requirements, there's a size and type of Pomona Pump that will do your pumping job better—longer—*for less!*

Your nearest Pomona dealer will be glad to explain the many exclusive features built into every Pomona Pump—features that cut costs, increase efficiency, reduce maintenance. Get in touch with him today—or write direct!

POMONA Water-Lubricated PUMPS

POMONA PUMP CO., 120 Broadway, New York City. Plants at 4301 So. Spring Ave., St. Louis, Mo. and 206 Commercial St., Pomona, Calif.

*Name on request.

bearings keep cool

as a cucumber

since this plant switched to Tycol Green Cast Greases

"We gave Tide Water the toughest lubricating job in our plant, and it is doing it to our satisfaction," declares the chief engineer of this company. "It has smoothed out for us the troublesome problem of lubricating the *rubber* mill bearings.

"Never since we started using Tide Water Green Cast Grease have we had a single bearing overheated – even though we have been operating 24 hours a day, six days a week. Our greasing problem has been reduced to simply filling the cups once every eight hours."

If lubricating problems hamper sustained operation in your plant, call in a Tide Water engineer. He will study your problem and recommend the proper Tide Water lubricant "engineered to fit the job." Write today for complete details to Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

INDUSTRIAL TYCOL ORS-GREASES

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

THE IMPORTANCE OF *Symbols*

From their easy-to-grip hand-wheels to their generously oversized bodies; —from their extra heavy wear - resisting bronze stems to their husky Union Bonnets;—from their precisely machined bronze glands and extra deep stuffing boxes to their specially constructed discs, O.I.C. Valves will pay you dividends the minute they go on your lines.

Replace now with O.I.C. Join the growing number of users . . . all of whom are saying: *"Oh I See! Lower Costs with O.I.C."*

O.I.C. IS PREPARED TO FURNISH YOU SYMBOL INFORMATION ON "END USE"

O.I.C. is in position to help you in determining your proper "End Use" classifications and symbols so that your purchase orders to us may be correctly endorsed.

As a plus-service to the steadily growing number of users of O.I.C. valves, we have available for you a complete, concise and accurate reproduction of "End Use" Classifications and Symbols — their purposes and descriptions, plus general and specific instructions for their use.

You will find this manual a time and trouble saver. For example—if your "End Use" is in the power field, your Symbol may be 9.10; or — in the petroleum field you may require a Symbol 9.20; or — in the chemical processing field your Symbol may be 8.20 and in the paper and pulp industry, it may be 8.90.

Just write to us on your company letterhead, and we shall gladly send you your copy without obligation . . . or you may obtain a copy from your nearest O.I.C. Distributor.

And always remember . . . there's a sturdier O.I.C. Valve for your every "End Use" that will insure you:

★ Longer Uninterrupted Service
★ Lower Replacement Cost
★ Lower Maintenance Cost
★ Minimum Over-all Cost

OIC

THE OHIO INJECTOR COMPANY
WADSWORTH, OHIO
Quality Leaders in Valve Manufacture Since 1883

TOOLS OF VICTORY

DESIGN ENGINEERING CONSTRUCTION

PRITCHARD Integrated Service

includes all three . . . plus supervision and purchasing . . . in these essential industries—

NATURAL GAS	Compressor Stations Dehydration Plants
GASOLINE	Natural Aviation
STEEL	Plant Piping and Construction Dry Blast for Blast Furnaces
SYNTHETIC RUBBER	Plant Piping and Construction Dryers and Special Equipment
CHEMICAL	Plant Piping and Construction. Drying . . . Heat Exchange . . . Cooling Equipment

Also Cycling-Extraction Plants . . . Steam, Diesel and Gas Engine Power Plants . . . Propane-Butane Standby Fuel Systems . . . Cooling Towers . . . Heat Exchangers . . . Gas Cleaners

J·F·PRITCHARD & CO·

DWIGHT BLDG. KANSAS CITY, MO.

BRANCH OFFICES IN TULSA, OKLA. HOUSTON, TEXAS
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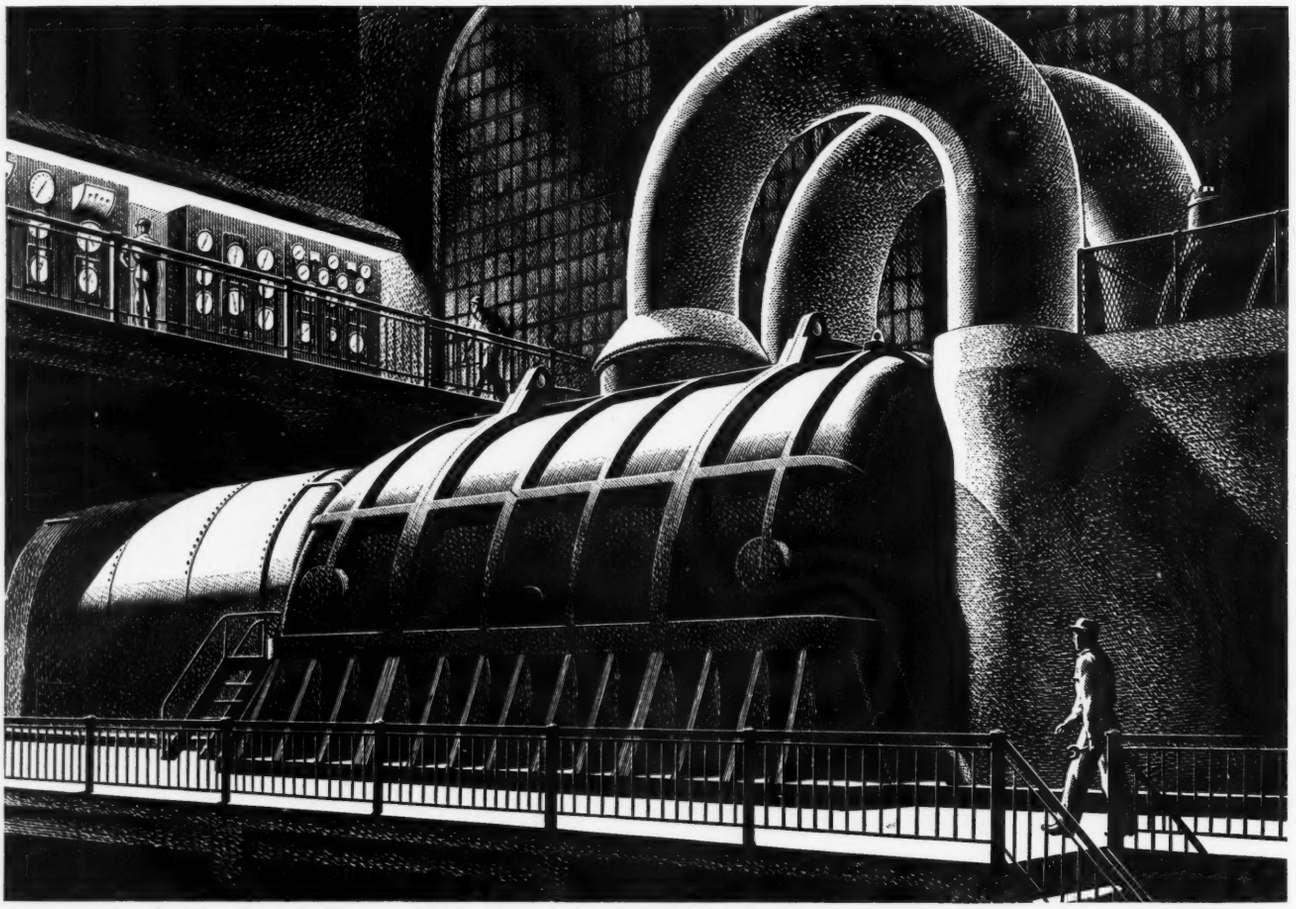
The call for kilowatts



UNIFORM BETH-CO-WELD PIPE

Back of every machine that turns for victory today stands the power industry, supplier of the vital energy that keeps the wheels going round. As production rates mount there is an ever-growing demand for kilowatts.

The power plants of America are meeting this demand, and Beth-Co-Weld Pipe is helping them to do the job. In maintaining or enlarging existing plants, in constructing new ones, Beth-Co-Weld can be installed with every assurance of dependability. Made by the continuous-weld process, it is uniformly good—in working qualities, and in physical characteristics.

Beth-Co-Weld is made in all sizes up to three inches, in black and galvanized finish, in standard weight and extra-strong. It is furnished in uniform 21-foot lengths, plus or minus 1 inch, for your greater convenience in handling and installing.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

YOU CAN'T GET A NEW BOILER OVERNIGHT

but you can increase the output of your present equipment without delay!

PERHAPS you may need new units to enable you to meet your peak demand. But it takes time to design, secure materials and erect new boilers —and time is short. So you are probably looking for ways and means of getting greater output from your present equipment.

One way of immediately improving your boiler operation is to use "Carbofrax"—the Carborundum Brand Silicon Carbide Super Refractory—in the clinker zone of the setting. Since "Carbofrax" brick do not soften at the high temperature encountered, clinkers do not build out on their hard dense face. Consequently, full grate capacity is assured and maximum steam production obtained. Moreover, eight to ten years of continued service is not unusual for "Carbofrax". And this longer life reduces refractory and labor costs, eliminates frequent and worrisome shutdowns for repairs due to lining failures.

Why not find out how "Carbofrax" can increase the efficiency of your boiler operation? We will be glad to assist you in making the application to your furnace. A letter or call to the nearest representative will bring a prompt response. A "Carbofrax" setting is a dependable setting.

REFRACTORY CARBORUNDUM PRODUCTS

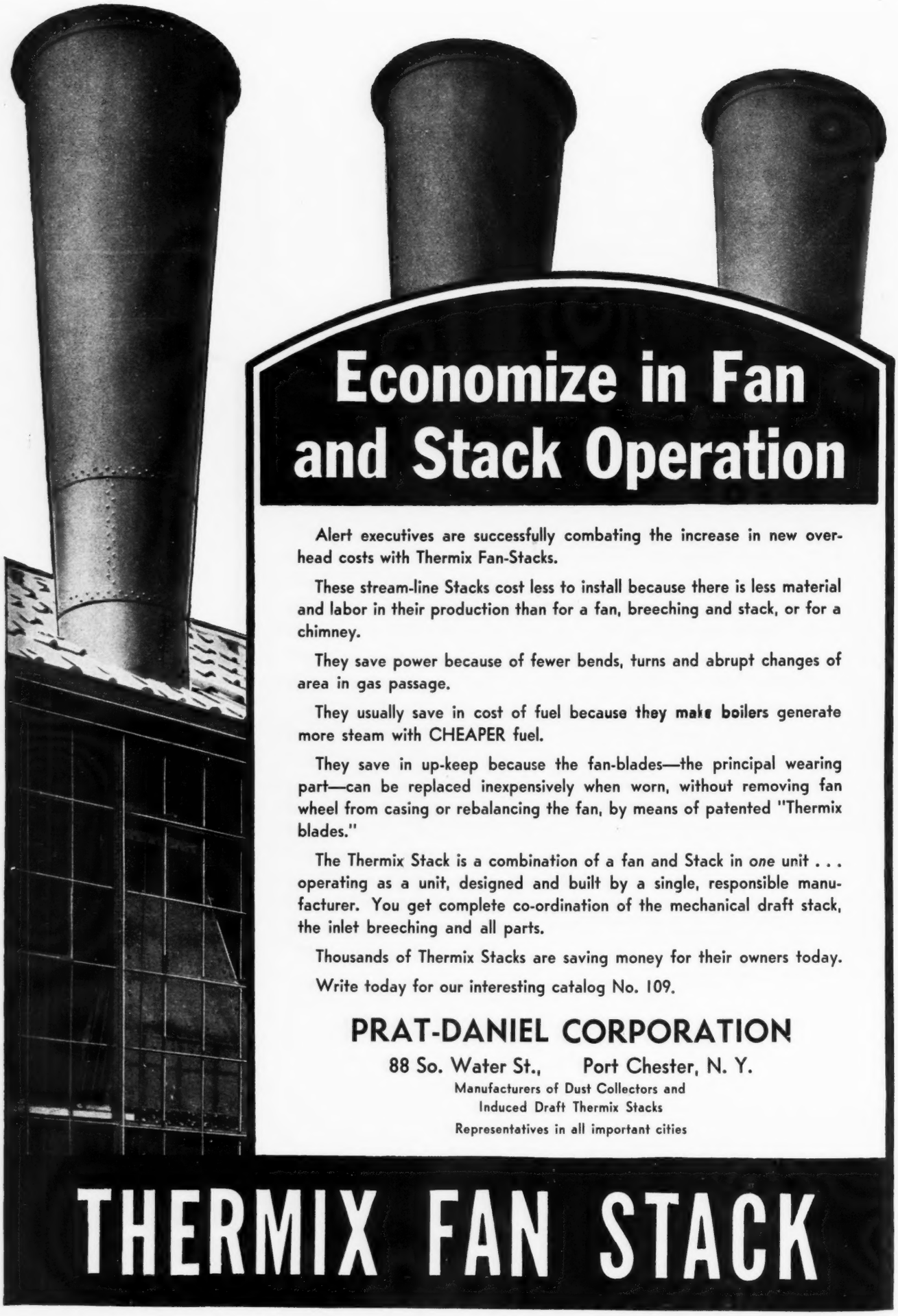
THE CARBORUNDUM COMPANY, PERTH AMBOY, N. J.

REG. U. S. PAT. OFF.

Refractory Division

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum and Carbofrax are registered trade-marks of and indicate manufacture by The Carborundum Company)



Economize in Fan and Stack Operation

Alert executives are successfully combating the increase in new overhead costs with Thermix Fan-Stacks.

These stream-line Stacks cost less to install because there is less material and labor in their production than for a fan, breeching and stack, or for a chimney.

They save power because of fewer bends, turns and abrupt changes of area in gas passage.

They usually save in cost of fuel because they make boilers generate more steam with CHEAPER fuel.

They save in up-keep because the fan-blades—the principal wearing part—can be replaced inexpensively when worn, without removing fan wheel from casing or rebalancing the fan, by means of patented "Thermix blades."

The Thermix Stack is a combination of a fan and Stack in *one* unit . . . operating as a unit, designed and built by a single, responsible manufacturer. You get complete co-ordination of the mechanical draft stack, the inlet breeching and all parts.

Thousands of Thermix Stacks are saving money for their owners today.

Write today for our interesting catalog No. 109.

PRAT-DANIEL CORPORATION

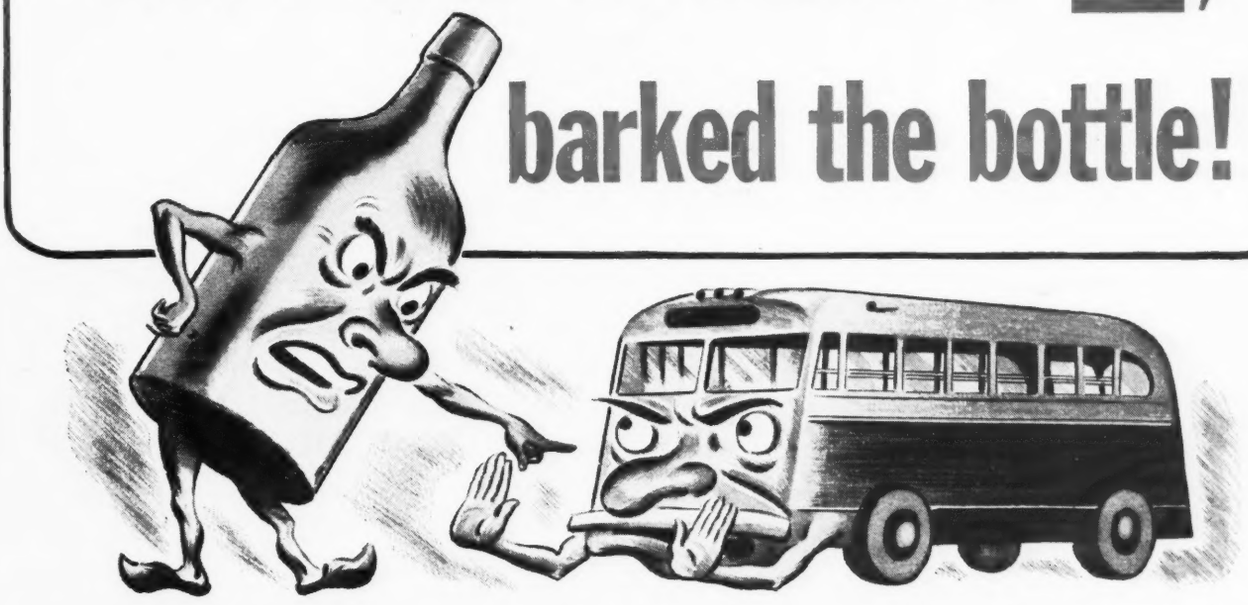
88 So. Water St., Port Chester, N. Y.

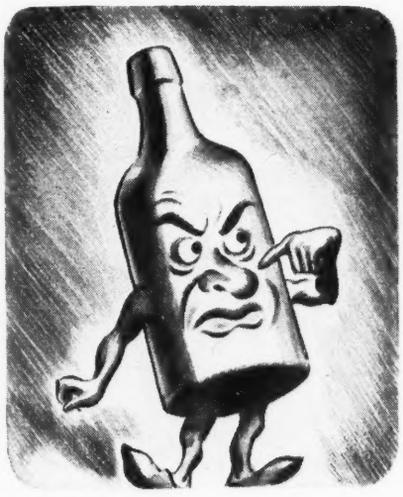
Manufacturers of Dust Collectors and
Induced Draft Thermix Stacks

Representatives in all important cities

THERMIX FAN STACK

"Don't talk TOUGH to me," barked the bottle!





"I CLAIM *I've* got the toughest job in the world for Diesels! At the F. E. Reed Glass Co., manufacturers of all types of glass containers, in Rochester, N. Y., we have 5 Ingersoll-Rand Diesels, and boy do they work! 24 hours a day—seven days a week—at peak capacity! And do you know something? Since we discovered a certain oil, in 14 months we haven't had a stuck ring or valve. In 50,000 hours of operation we haven't had anything but perfect lubrication! Top that, my friend."

"OKAY, BOTTLE! Down in West Virginia where *I* hail from, the Pittsburgh-Weirton Bus people travel their buses over mountainous country. Toughest going you ever saw. They've covered more than 500,000 miles of it, too! And since we discovered *our* secret we've been able to more than double the time between oil changes. Rolling 21 hours a day, in low gear almost all the way, our engines are cleaner than ever, bearings in topnotch condition, rings free!"

BOTTLE: "Sounds almost unbelievable, Brother Bus! I don't see how you can do it—unless you use the same oil *we* do . . . RPM DELO."

BUS: "I do, Brer Bottle! Indeed, my boss wouldn't think of using anything else *but* RPM DELO. Fact is, I can't see why anybody should use anything else."

ORDER RPM DELO FOR YOUR DIESELS

RPM DELO is marketed under the following names:

Caltex RPM DELO · Kyso RPM DELO · RPM DELO · Signal RPM DELO · Sohio RPM DELO

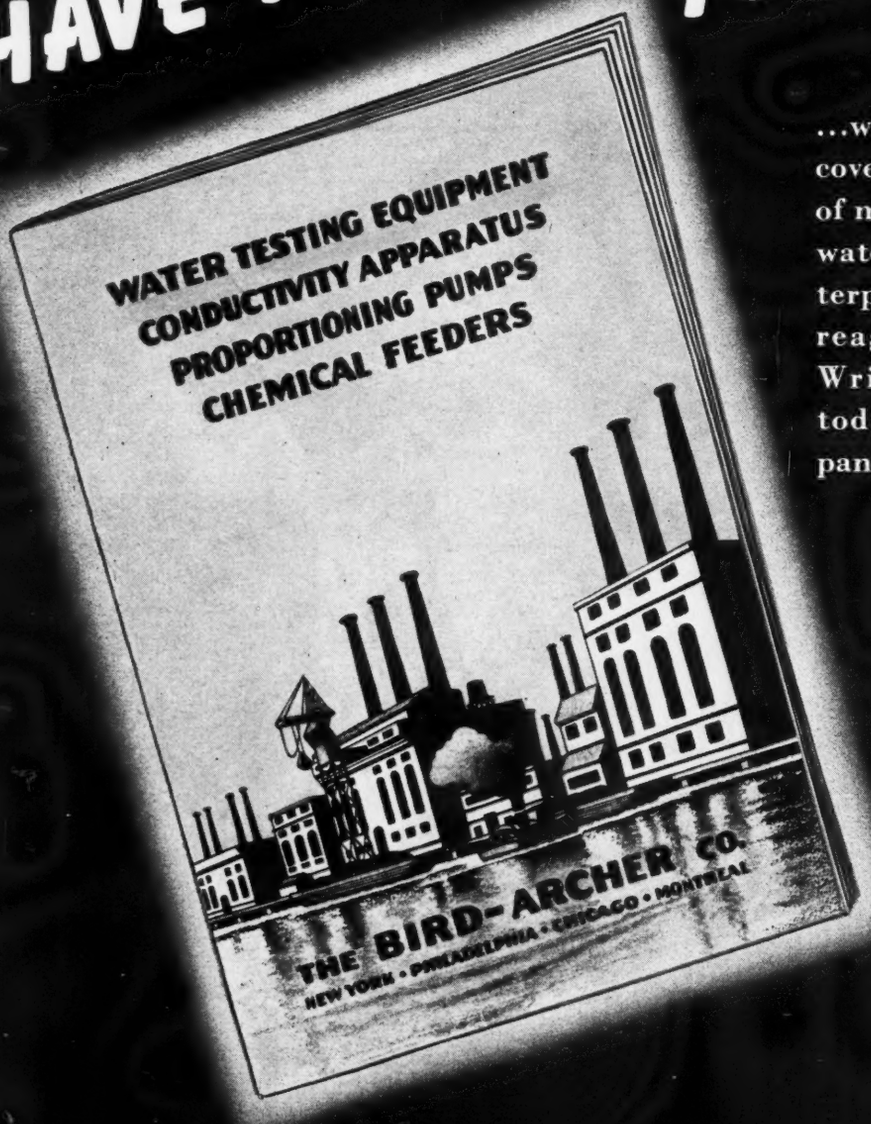
Imperial-RPM DELO
CONCENTRATE

Ask your Diesel engine manufacturer or distributor for the RPM DELO supplier in your vicinity.

RPM DELO
DIESEL ENGINE LUBRICATING OIL

STANDARD OIL COMPANY OF CALIFORNIA

HAVE YOU SENT FOR YOUR COPY ?



...with a special section covering the procedure of making all necessary water analyses, their interpretations, and the reagents required... Write for your copy today — on your company letterhead, please.

THE BIRD-ARCHER CO.

Scientific Water Conditioning
SINCE 1885

Philadelphia, Pa.
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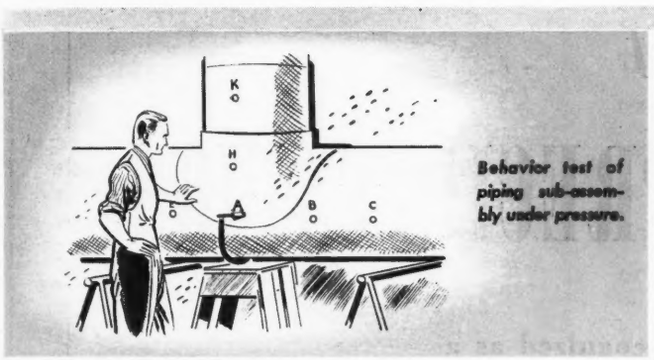
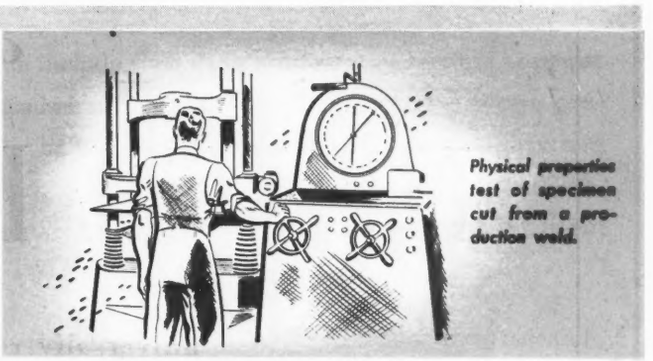
7-BA-1

Continuous RESEARCH

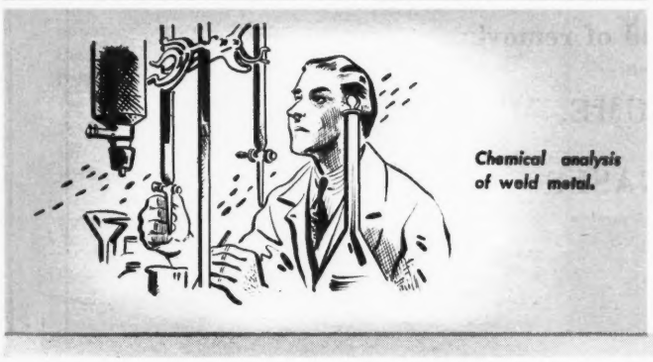
TO IMPROVE PRESSURE PIPING



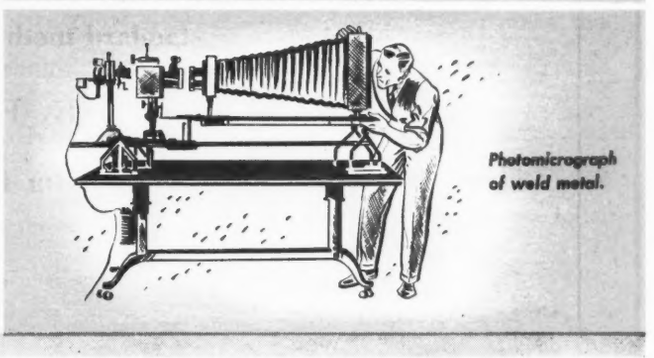
Behavior test of piping sub-assembly under pressure.



Physical properties test of specimen cut from a production weld.



Chemical analysis of weld metal.



Photomicrograph of weld metal.

Members of the Pipe Fabrication Institute conduct continuous research for the improvement of pressure piping in general, and pre-fabricated piping in particular. It is research which makes the qualified fabricator ready with improvements when they are needed —able to meet the new piping demands which are constantly arising. The result is substantial savings to industry.

Behavior of piping sub-assemblies under pressure and temperature . . . physical tests of weld specimens . . . chemical analyses to determine possible chemical changes produced by welding . . . photomicrographic inspection of weld sections . . . X-raying, etc., reveal much important data used in maintaining close control and supervision over the whole shop fabricating process.

Any qualified pipe fabricator will make such data available to help you secure piping which exactly meets your requirements.

P.F.I. THE PIPE FABRICATION INSTITUTE

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DO MORE · LAST LONGER

For industry, this is a war of conservation of production equipment—especially of equipment that is becoming difficult to replace—like mechanical rubber goods.

These include such widely different necessities as power transmission belts—both of the flat and V types; conveyor belts to transport the materials of industry and construction; hose for water, steam, air, oil, gasoline. There are thousands of other items of rubber equipment or parts important for Victory.

Because of its wealth of experience and research, MANHATTAN is able and glad to help you make the mechanical rubber goods you now have last longer.

MANHATTAN field representatives, service men and the trained personnel of its distributors are all available to help by specific suggestions.

IMPORTANT SUGGESTIONS

BELTS

Keep pulleys clean, in good condition and in correct alignment so that belts will run true and wear evenly.

A belt that is too tight may cause fastener and bearing trouble. If too loose, may slip and wear.

Use belt dressing on flat belts only when essential and then as recommended by rubber manufacturers.

Too high temperature will shorten belt life.

Oil deteriorates rubber belts.

Tight side down gives greater arc of contact, delivers more power.

Use right size and type belt, install correctly and use proper type and size fasteners.

Too small pulleys may shorten life of belt.

Rubber belts should be stored in a cool, dark place.

Write factory or ask distributor to send a MANHATTAN service man.

CONVEYOR BELTS

Make sure idlers turn freely and are lubricated properly so oil or grease will not injure belts.

Avoid long drops for heavy materials.

Load evenly and centrally. Irregular, uneven or heavy loading causes spillage, also tends to make belt run crooked and wear unevenly. Hard or jagged pieces passing between pulleys and belt will damage the belt.

Don't overload or overspeed conveyor.

Use end pulleys of ample size.

A MANHATTAN field engineer or service man will be glad to examine your installation. Write factory or distributor.

HOSE

Avoid sharp bends at fittings; also twists and kinks in body of hose.

Attach couplings carefully, forcing shank straight into hose, using soap and water lubricant.

When not in use, roll up or suspend hose.

Do not let hose lie in sun, hot or damp places.

Do not permit heavy objects to run over hose.

Avoid excessive temperatures, violent fluctuations of pressure.

Straighten hose before dragging and while unpacking. Do not forcefully bend, twist, kink or pull hose.

Use the correct type and size hose for the conditions.

Store in dark, cool place.

Consult MANHATTAN service man.

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RUST is a deadly enemy of production that attacks without warning. But it need not catch *you* napping. Drain and refill your turbines now with new, proved, service-tested Shell Turbo Oil . . . the turbine oil that meets all 3 vital requirements of modern turbine lubrication:

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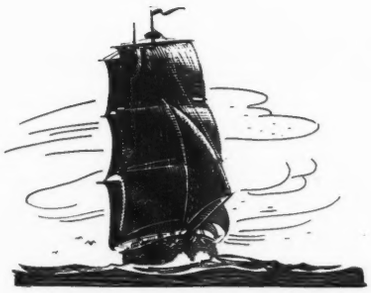


A sailing ship travels 24 miles an hour

A moose can run
28 miles an hour

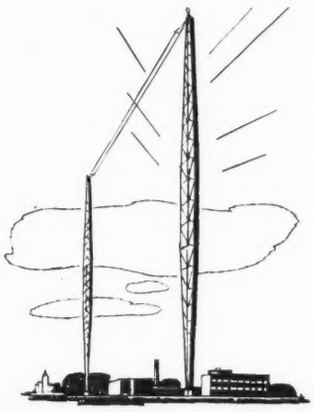
A jack rabbit hops 45 miles an hour

An ostrich runs 60 miles an hour

A swift flies 200 miles an hour

The automobile speed record is 301 m.p.h.

Sound travels 743 miles an hour



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miles an hour

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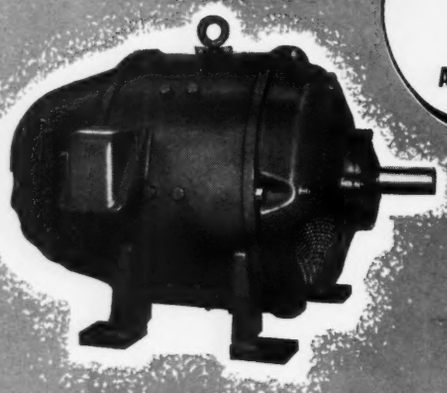
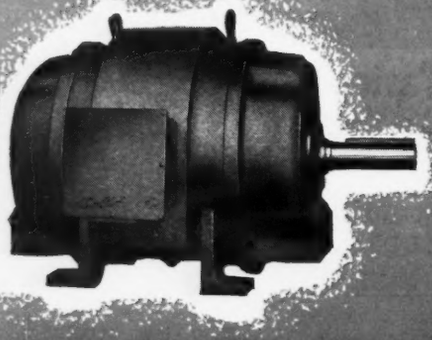
SLOW SPEEDS FOR INCHING, THREADING, INSPECTION

Applying them to boost production and improve quality is APPLICATION ENGINEERING. That's our business.



Type T Heavy-duty Reliance Motor for direct current with ball bearings.



Splash-proof Type AA Squirrel-cage A-c. Induction Motor with ball bearings.

LIKE MOST RELIANCE MOTORS, this one is more than the name plate says. It was sold *to do a job*—to go beyond providing power. It will take a definite part in a production process by performing functions such as:

Reliance "selling" is "engineering." It is cooperation in answering the question, "What can we get the motor to do besides supply power?" When you have plans afoot requiring new machines or processes, invite a Reliance man to sit in. He can help you get the most from the production aids which are inherent in motor-drive.

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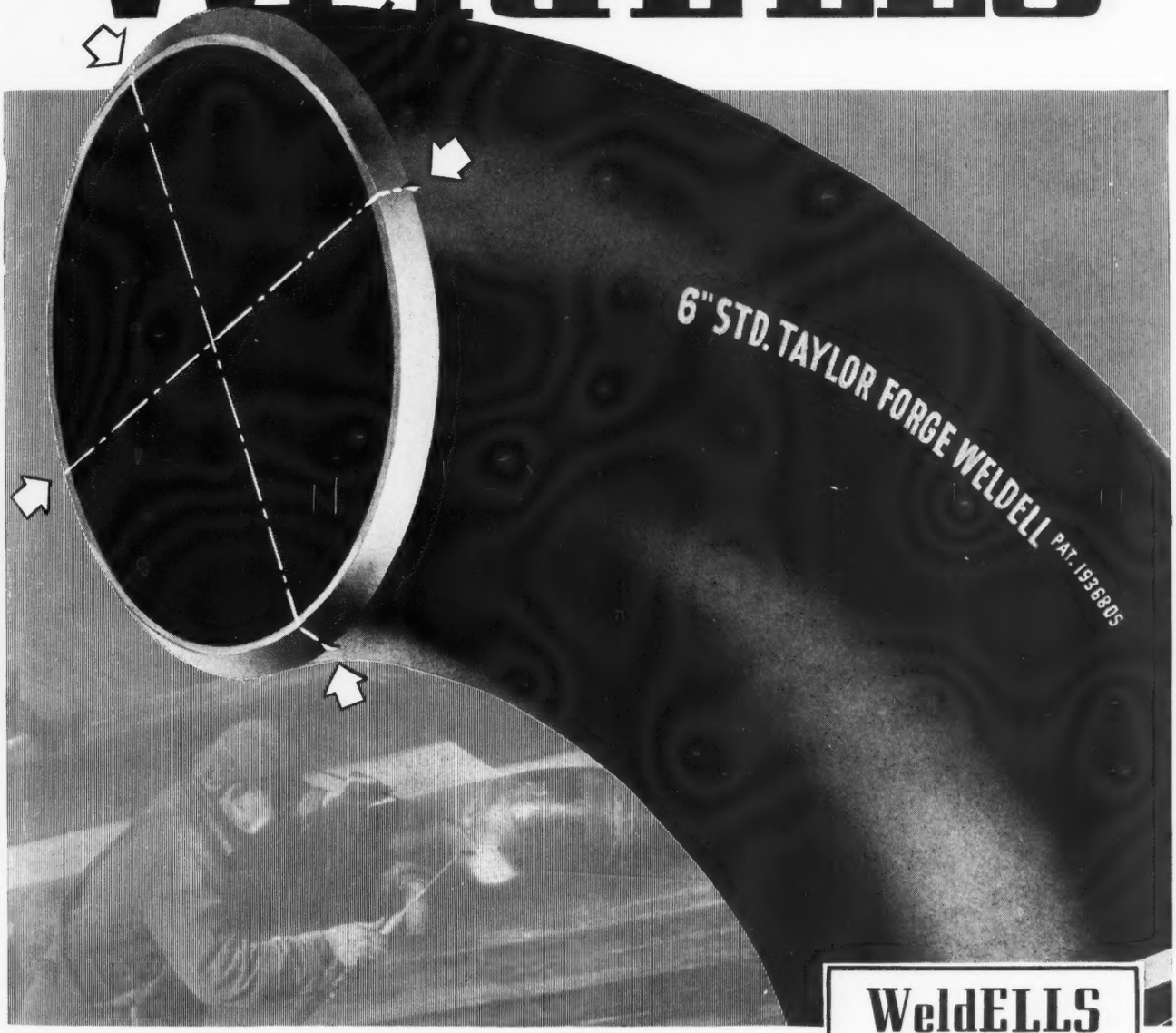
RELIANCE A-C D-C MOTORS

WeldELLS



THEY SPEAK HIS LANGUAGE
—these precision quarter-marks

Just ask the man who welds them, if you question the importance of these precision quarter-marks that are found only on WeldELLS and other Taylor Forge Welding Fittings.

He'll tell you how much time and trouble these reference points save in figuring center lines, angles and offsets; how much easier they make it to keep piping lined up in the proper plane. Fact is, this exclusive feature would be reason enough to insist on WeldELLS even if they didn't have the many other improving features listed opposite.

But quarter-marks are only one extra value of the fittings that have *everything* . . . for the man who specifies, welds, or pays the bill!

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New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

WeldELLS
have *everything*—

No other fittings for pipe welding combine these features which in addition to quarter-markings include:

▶ **Seamless**—Greater strength and uniformity.

▶ **Tangents**—Keep weld away from zone of highest stress—simplify lining up.

▶ **Selective reinforcement**—provides uniform strength.

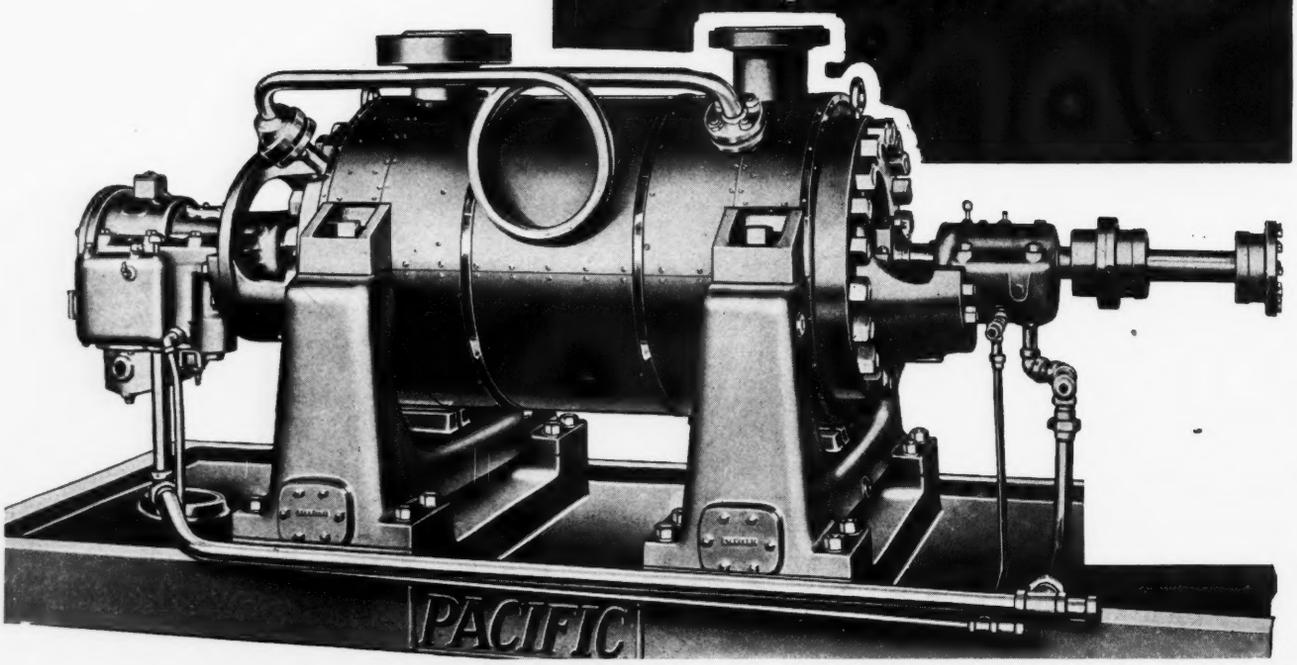
▶ **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.

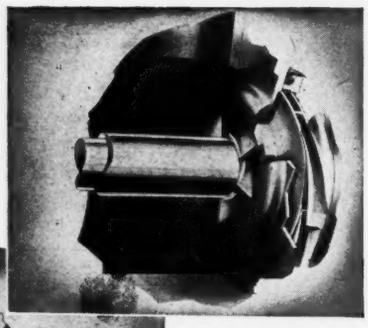
▶ **Wall thickness never less than specification minimum**—assures full strength and long life.

▶ **Machine tool beveled ends**—provide best welding surface and accurate bevel and land.

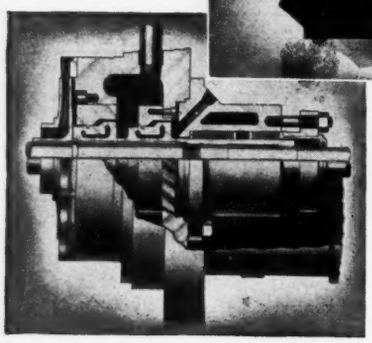
▶ **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

Exclusive Features Built into PACIFIC PUMPS Protect Present Owners Through the Duration

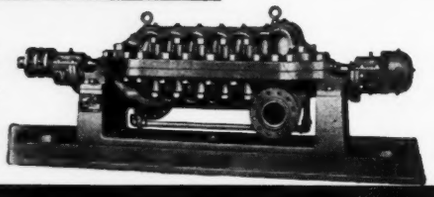




View of first-stage impeller showing how mixed flow impeller vanes extend out into the suction eye. Low suction veolcities are obtained through the design of the large suction bay and large area of first-stage impeller.



Arrangement of balanced, stationary, floating seals for reducing high suction pressure on pump packing and balancing pump thrust. Parts are corrosion proof and the sealing faces are hard faced.



Boiler Feed Pump "PACIFIC," Type P.M.B., 7-Stage, High Pressure, Horizontally Split, Centerline mounted.

The performance of Pacific Boiler Feed Pumps now installed is insured for the duration and long afterwards by design features that were foreseen and realized by Pacific Engineers years ago.

Pacific Pumps have been and always will be built not simply to meet the conditions of the moment, but to be ready and dependable to meet future and more severe conditions indicated by rising trends in operation.

Visualizing the constant increase in boiler pressures and temperatures, Pacific Pumps have anticipated demands that were certain to be made—before they appeared. Present owners of Pacific Pumps therefore consider themselves fortunate in having equipment that will carry them through—safely, continuously, economically.

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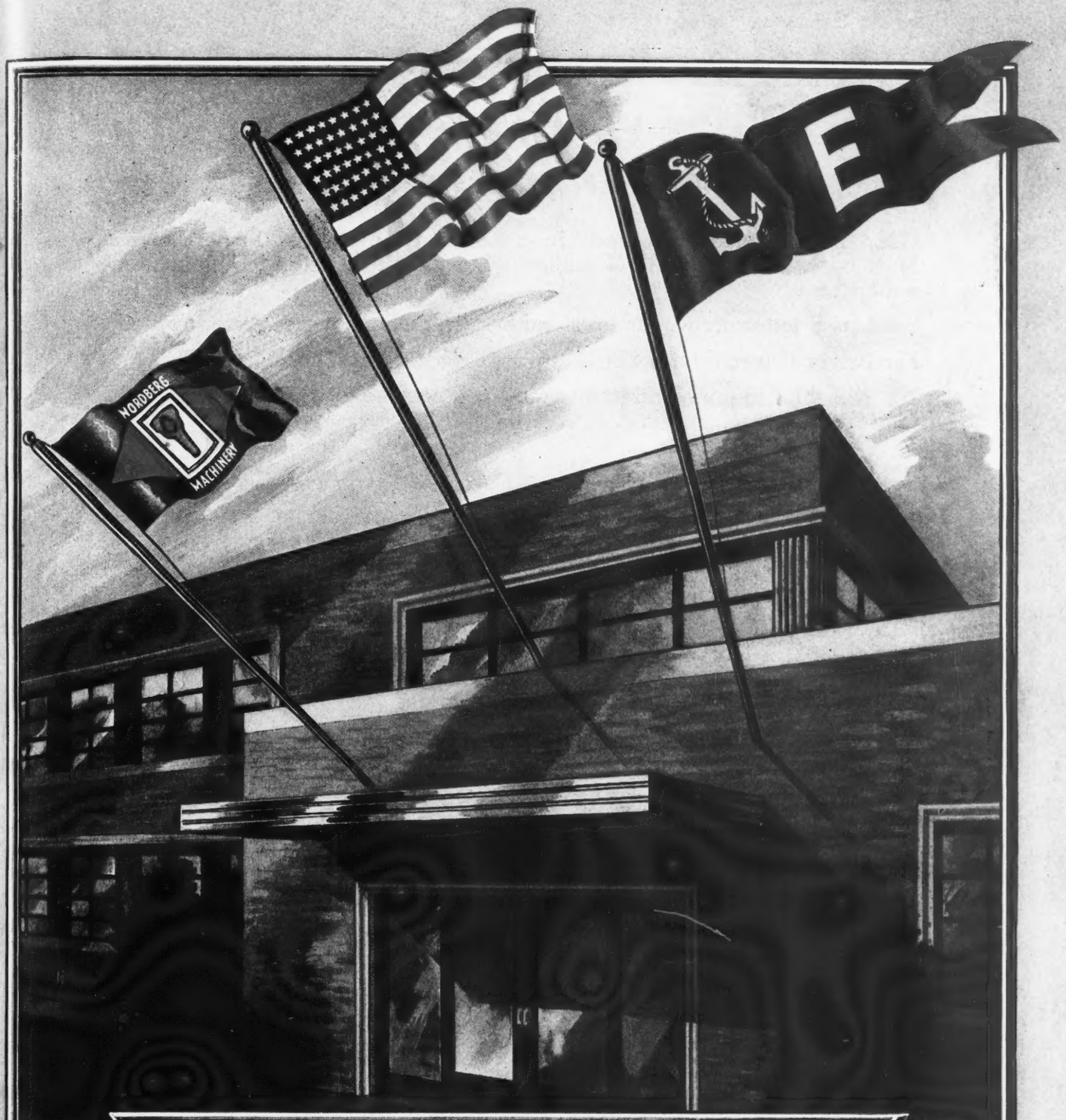
Sales & Service Offices in principal cities in the U.S.A.

Affiliated Companies: Clark Bros. Co., Olean, N. Y., Dresser Manufacturing Co., Bradford, Pa., The Bryant Heater Co., Cleveland, O.

PACIFIC *Engineered* PUMPS



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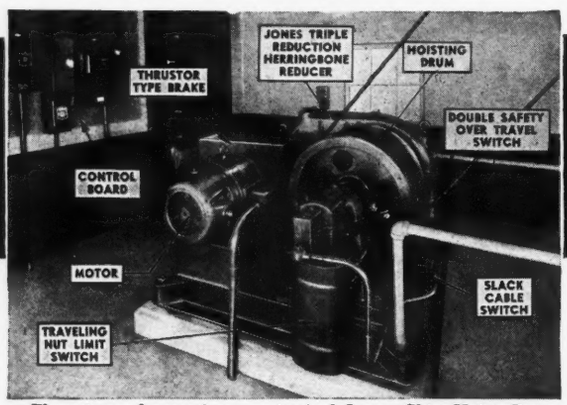
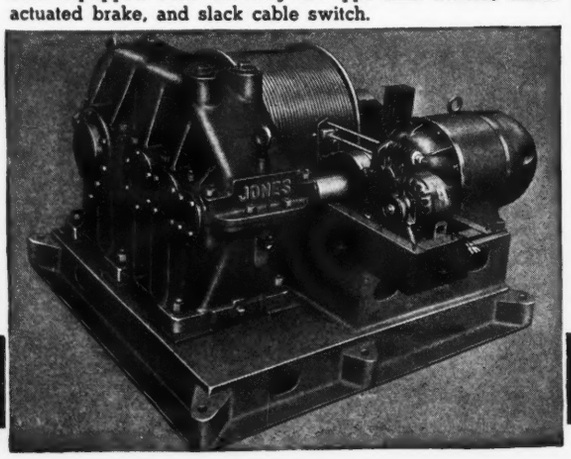
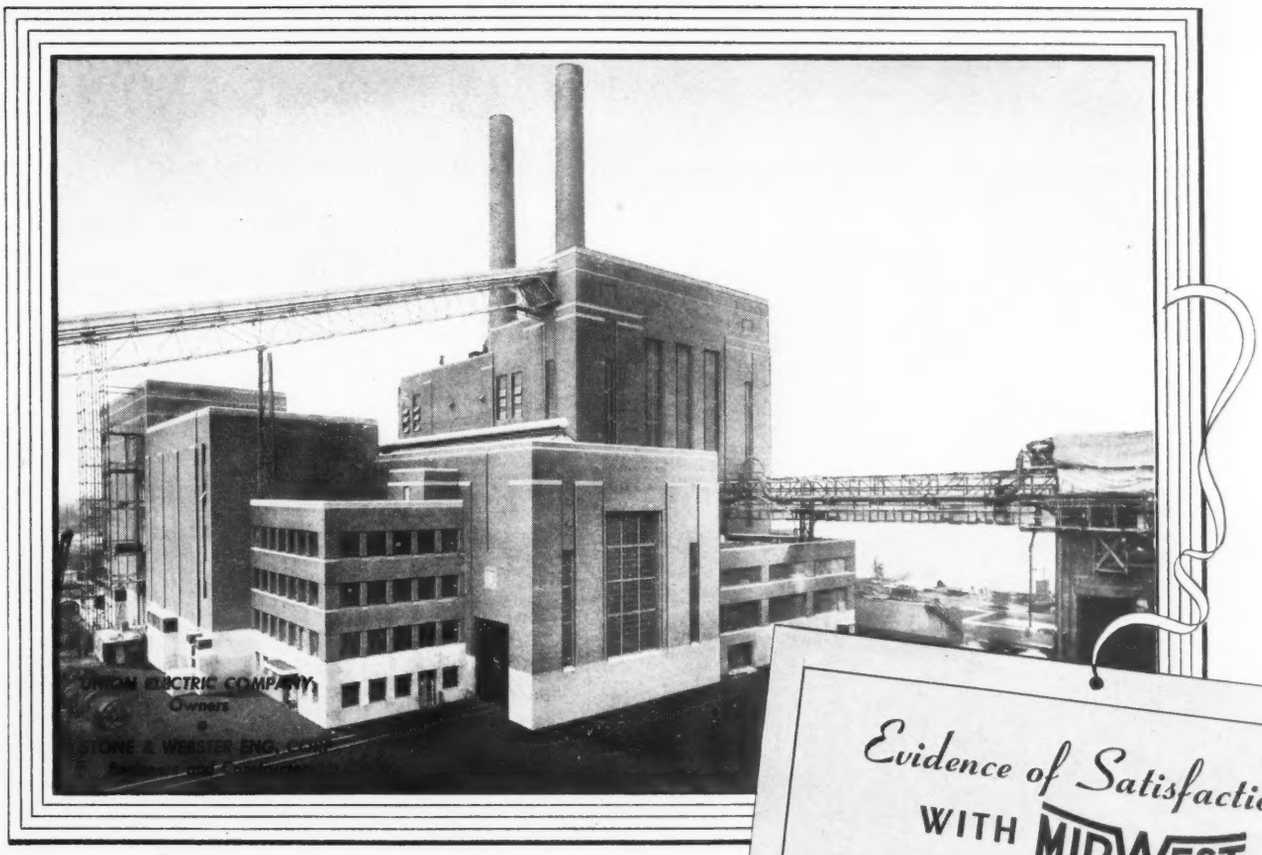


• The view above shows a typical Jones Skip Hoist Drive installation while the view below shows one of the Jones units equipped with traveling nut type limit switch, motor actuated brake, and slack cable switch.





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On the First Section (2-40,000 kw turbo-generators) of this new central station, Midwest was the piping fabricator and contractor. The results were so satisfactory that Midwest has been awarded all piping for the Second Section (1-80,000 kw unit) now being added as rapidly as possible.

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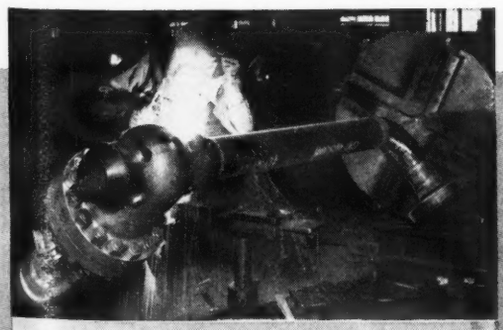
Whenever you need fabricated piping (either with or without erection), you will find it advantageous to use Midwest Piping.



Shop welding a sub-assembly of the 1500 lb. boiler feed piping. Note special rotating machine enabling qualified welder to always work in most advantageous position.

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PIPING & SUPPLY COMPANY, Inc.

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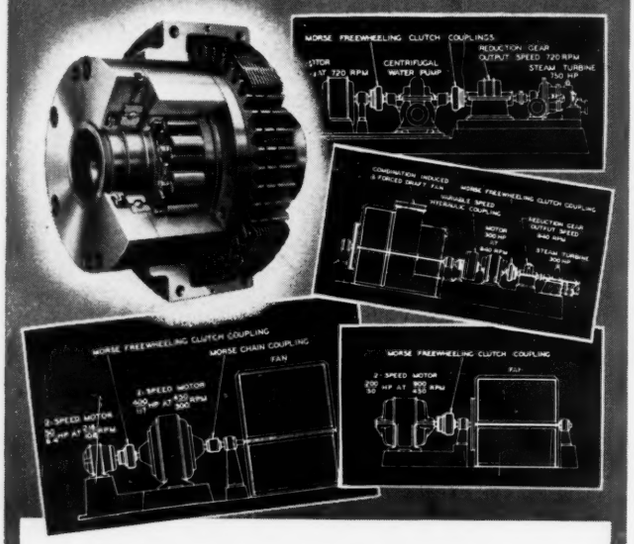

Morse Free-Wheeling Clutches have flexible couplings integrally built into one highly compact free-wheeling clutch unit. They are unsurpassed as an efficient, automatic, dual-drive connecting medium.

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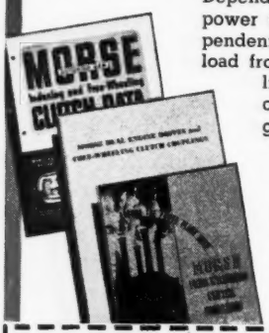

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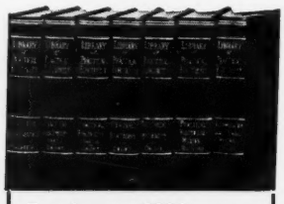

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7. Do you have sufficient knowledge of mathematics to understand simple formulae, charts and graphs?
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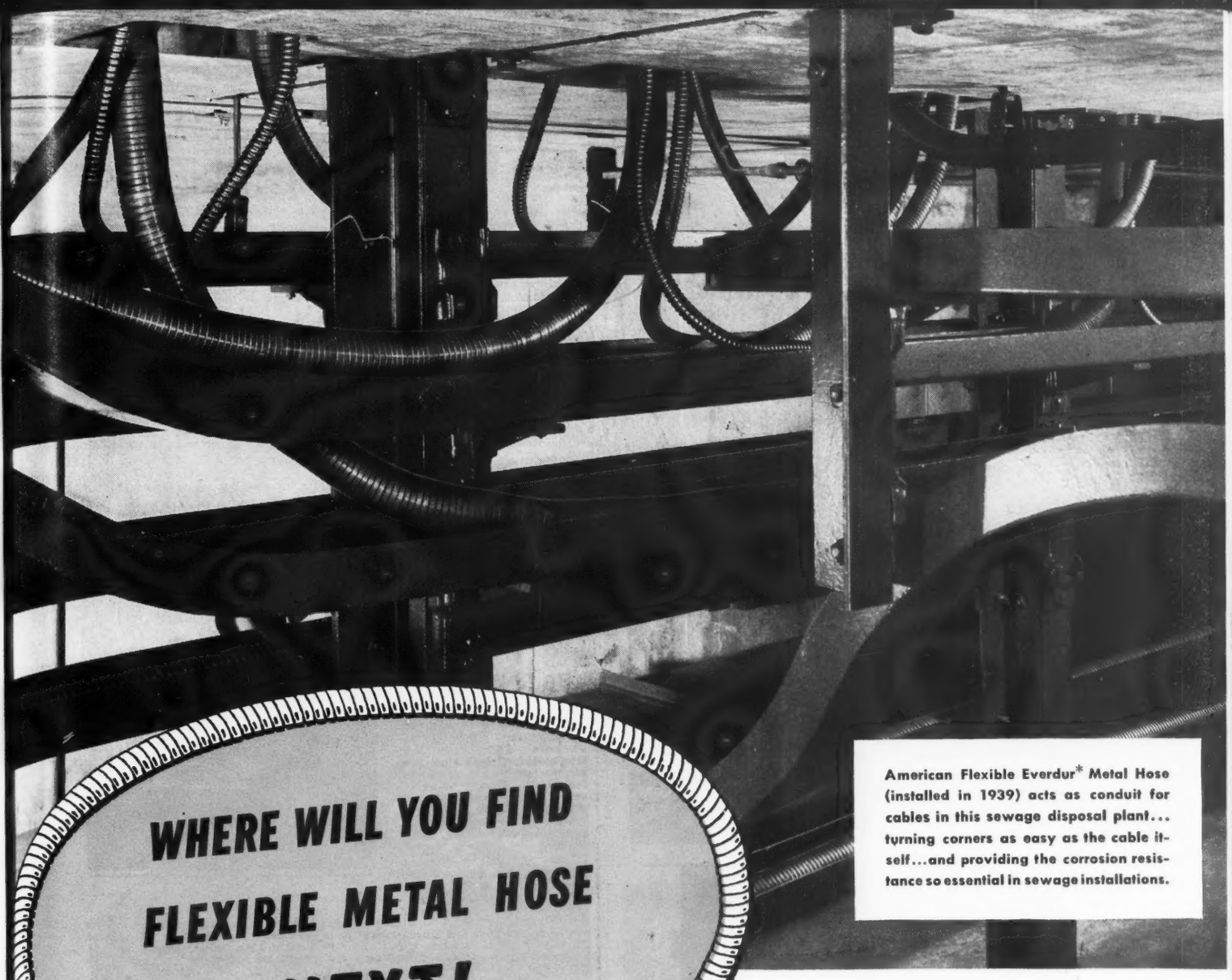

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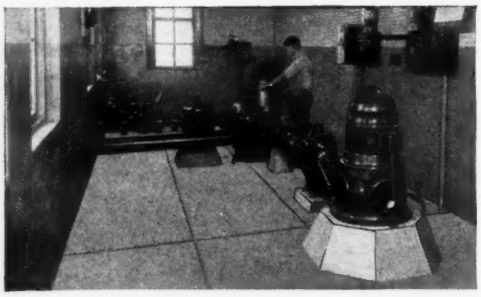

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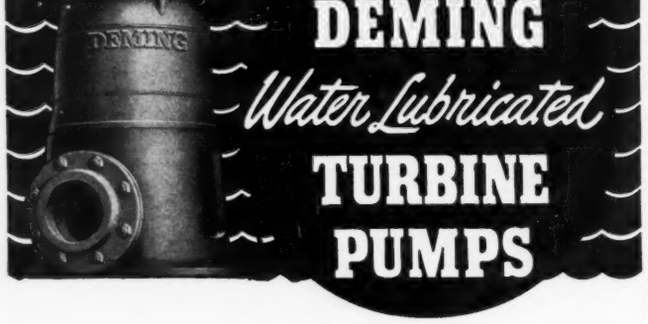

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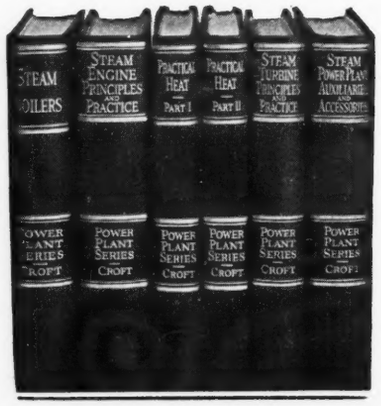
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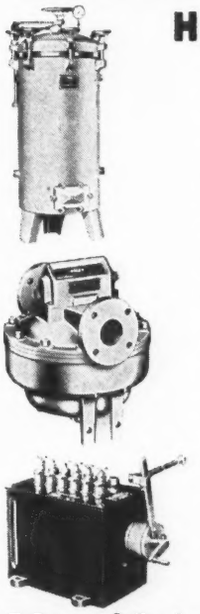

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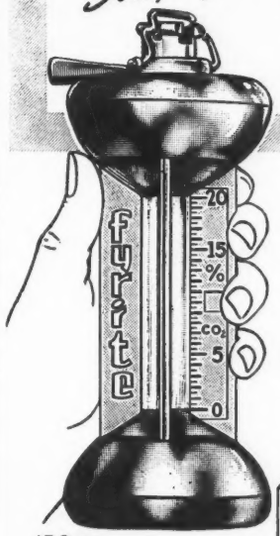

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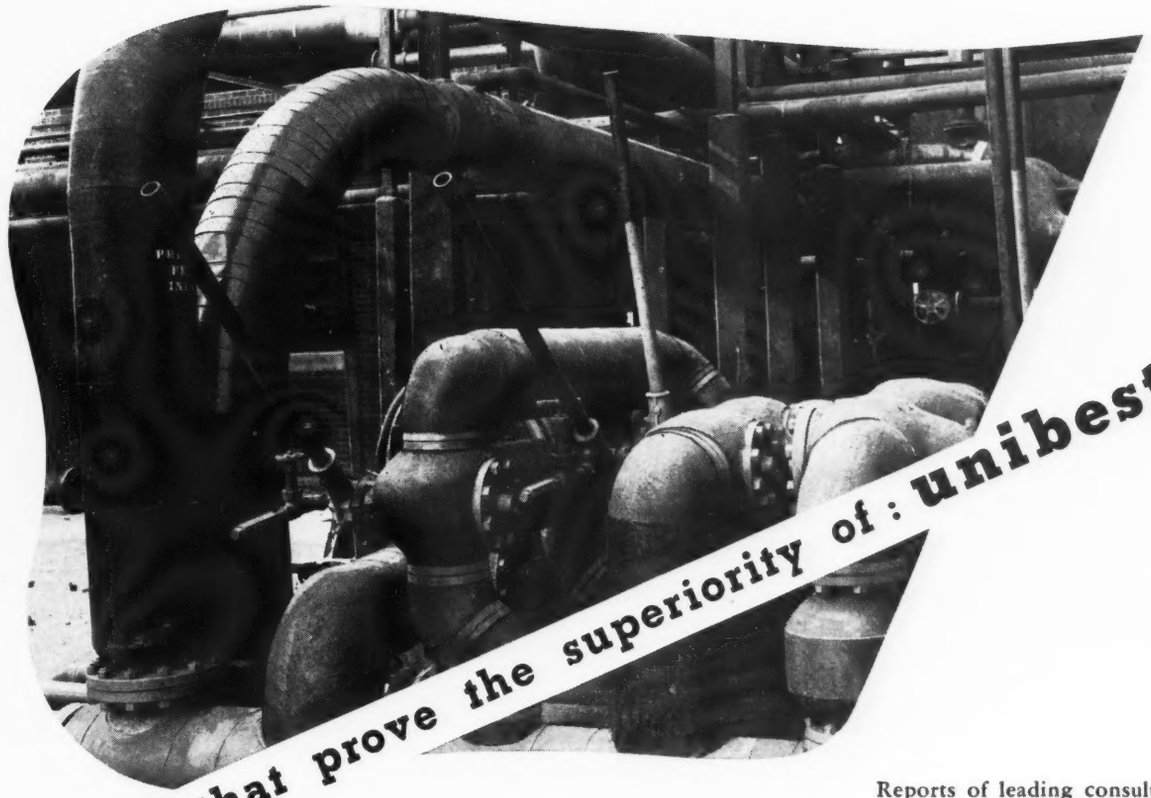

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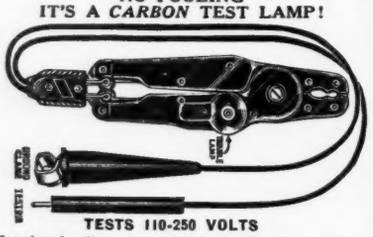

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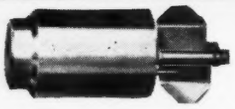

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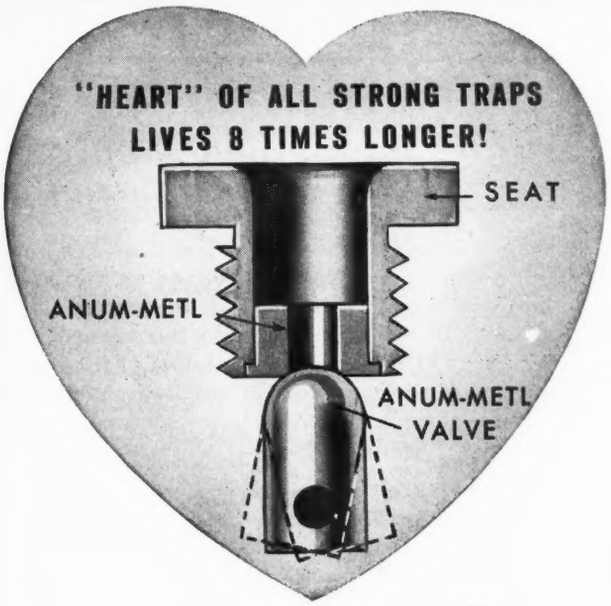

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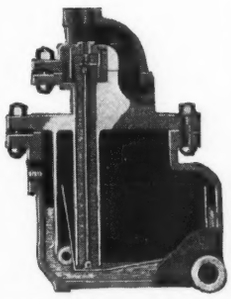

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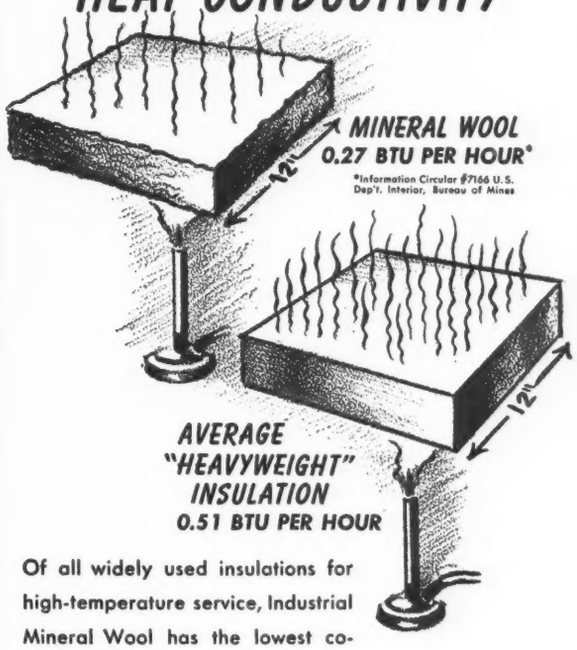

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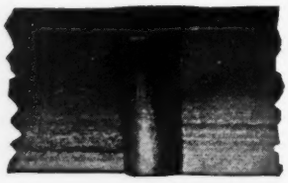

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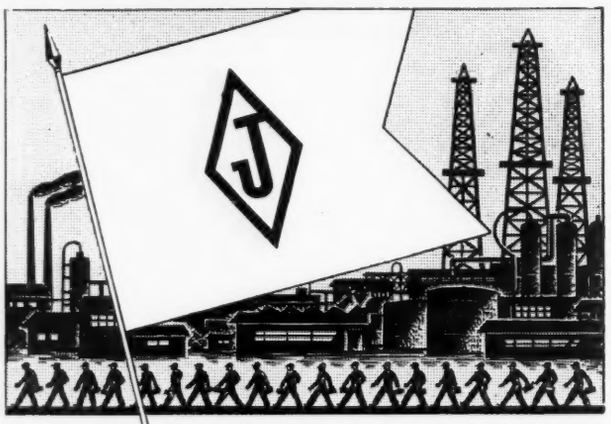

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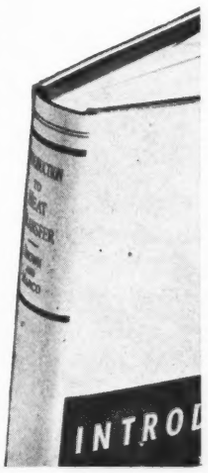

Just Published!

INTRODUCTION to HEAT TRANSFER

By AUBRY J. BROWN, Professor of Heating and Ventilating, Ohio State University *and* SALVATORE M. MARCO, Assistant Professor of Mechanical Engineering, Ohio State University

232 pages, 6 x 9, 60 illustrations, $2.50

Provides a clear conception of the manner in which heat is transmitted and of the development of the fundamental mathematical expressions that apply to the calculations of heat transfer through clean surfaces. Includes useful reference data, and many numerical illustrations. Complicated mathematics is reduced to a minimum by application of the principles of dimensional analysis.

Gives illustrations of the application of the principles of heat transfer in the design of a feed water heater, a surface condenser, and a fin-tube fan coil, each with complete calculations and in form to illustrate the way in which it may be necessary to modify or build upon principles when applying them to design problems.

Contents

Modes of Heat Transfer.
Heat Transfer by Conduction.
Equations for the Calculation of Heat Transfer by Conduction (Steady State).
Radiation.
Introduction to the Study of Convection.
Forced Convection.
Free or Natural Convection.
Heat Transfer to Boiling Liquids.
Condensing Vapors.
Over-all Transfer of Heat.
Application of the Principles of Heat Transfer to Design Problems.
Variable Heat Flow.

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Key to

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With America's War Production on a 24-hour-a-day basis, it's easy to overload your boilers. This means a frequent checkup is absolutely necessary. ● The Electric Chemical Company's service engineers maintain constant contact with every industrial section. We will send an experienced engineer for consultation on your boiler and water treating problems, at no obligation. ● Conserve your equipment and its efficiency by asking the Ecco service engineer to analyze your water problems due to scale, corrosion, color, taste, odor or water softening related to process or boiler feed.

ECCO CATALYZERS
FOR WATER CONDITIONING

ELECTRIC CHEMICAL CO.
8001 FRANKLIN AVE. • CLEVELAND, OHIO

. S., Soviet Agree | Germans Claim

a 75-ton kick in the panzers!

Confidence is the strong and good cousin of that horrid word complacency. Most Americans are confident, few are complacent today. Confidence is our heritage, bequeathed to us by the pioneers, and nurtured by headlines of industrial marvels.

From the day when the Flatiron Building made news, to the colossal statistics of Grand Coulee, we have become firmly convinced that no task is too great for our vast construction industry.

That conviction is justified. A year before Pearl Harbor Sunday was anything more than a gleam in treacherous oriental eyes, our engineers and contractors were moving earth faster than it had ever been moved before . . . in preparation for projects which since have made our skyscrapers and giant bridges look like mere trial heats.

You know part of the story. We can't tell it all . . . complete aluminum plants built between Christmases . . . whole farms transfigured into bomber plants in less time than elapses between crops of corn . . . great shipyards in operation today on inlets that were frog ponds when the "Battle of Britain" was at its height.

How were these miracles of construction performed?

We can't call it genius. Germany, in particular, has many great engineering minds, yet the entire Axis is outstripped by our capacity to do big jobs fast.

We can't explain it by just calling it skill and experience. The new shipyards prove that . . . our skilled and experienced shipbuilders were absorbed by navy construction long ago. Yet we have met each new quota of cargo shipbuilding. Deep in our hearts we all know industry will meet whatever quota may be needed however impossible that may seem now.

▶ Some of these cargo ships and shipyards are being built by landlubbers . . . by men who knew nothing of the sea, but who were hell on reading blueprints and at designing and operating complicated machines.

There are several reasons why ordinary Americans become Supermen when faced by "fantastic" construction jobs.

▶ The first reason is the intrepid spirit of the management and men of American construction. With a slide rule in his hand, the most meek and stoop-shouldered of American engineers becomes a high adventurer. He is willing to gamble that the machines and men at his command can lick anything this side of the fourth dimension.

The second reason is motive power. The leaders of our construction industry have always had the guts to gamble the cost of big machines to do big jobs. Probably the rest of the world combined cannot match our array of power shovels, scrapers, bulldozers, compressors, welders, motors and engines for moving and moulding earth, water, steel and stone.

The third reason is men. A shovel weighing 75 tons needs a "75-ton mind" at the control levers . . . American labor takes to machinery as a co-ed takes to "swing."

The fourth reason is versatility. The construction industry is used to turning corners at high speed . . . to an organization that has built railroads, cathedrals, bridges, and movie palaces, making a munitions plant in a hurry just means more men, more machines and more night work, and more of that good American ingenuity.

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W. P. B. . . . . this advertisement is published by the McGraw-Hill Network of Industrial Communication.

P.S. The fifth reason is "mobilized information"

Through a distinctively American process, the Industrial Press, trial and error are reduced to a minimum. Information on successful new techniques flows freely from job to job.

If a factory in Kansas succeeds in laying the dust and stopping ruts in its parking lot, an engineer with the job of quick-surfacing a jungle airport reads how it was done in a construction magazine.

If a shipbuilder finds he can cut construction time in half by building hulls upside down, other shipbuilders learn about it from their technical magazines.

At McGraw-Hill alone 153 editors and 725 field-correspondents are constantly combing construction as well as industrial jobs to find new and faster methods. This "know-how" is then routed through industrial magazines to every industry where it can be helpful.

In addition to the editors, many industrial advertisers keep men in the construction field to watch the performance of their machines. Their reports are used in industrial advertising to show operators how to make machines do more work and last longer in these days of shortages of time and metal.

. . . Now this advertisement contains a moral and "commercial." The commercial objective is obvious. The moral is this:

▶ Let's remember how well government, management and labor are getting along together in the face of visible peril. When the war is all over, we need have no fear of the invisible perils of peace, if we tackle our jobs in the same cooperative spirit.

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More than 1,000,000 of the executives, designers and production men, who give America her world supremacy in technical "know-how," use the editorial and advertising content of the 23 McGraw-Hill publications as a means of exchanging ideas.

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The Genuine **Squires**

Boiler Feed Water Controller

will maintain a constant water level in your boilers and will feed them in proportion to the evaporation.

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The feed valve is operated by boiler pressure —insuring positive functioning.

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X-PANDO *Pipe Joint Compound*

ONE FORMULA FOR ALL USES

EXPANDS AS IT SETS— ENDS LEAKS PERMANENTLY

6 FOR ONE ECONOMY— CUTS COSTS BY 50%

IT'S THE EXPANSION THAT CORRECTS IMPERFECTIONS IN THREADS

HOLDS ANYTHING CARRIED IN METAL PIPE

NOT AFFECTED BY VIBRATION; WITHSTANDS DEFECTION, HIGH TEMPERATURES

Aggressive plumbers please note: X-Pando Pipe Joint Compound is used for industrial plumbing and is known in all important industries, nationwide. Ask your mill supply house for all the facts about X-Pando Pipe Joint Compound.

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Canadian Distributors: La Salle Products Ltd., 159 Jean Talon St. W., Montreal, Quebec, Canada

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THE BROWNELL COMPANY — The World Over — SINCE 1859 — DAYTON, OHIO, U.S.A.

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Write us for illustrated bulletins.

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You will help us give you the good service that is your due by notifying us at once of your change of address. Often the monthly issues of POWER go out of print almost immediately after publication, preventing us from supplying issues that may have been misdirected. Prompt notification of address changes that have been made or will be made prevent your missing a single one of the big valuable monthly issues of POWER.

. . . if so, please fill in and return adjoining coupon.

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New Co. ..... *Position*.....

(Send to Circ. Dept., POWER, 330 W. 42nd St., New York, N. Y.)

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BOILER INSPECTOR
WANTED

National organization has opening for permanent position as Boiler Inspector. Applicant to have equivalent of second-class operating license or boiler shop experience. Must be in Class 3B or below in draft. Insurance inspectors now employed not to be considered. In first letter state age, number dependents, salary desired, location preferred, brief experience record.

P-291, Power
330 West 42nd St., New York City

POSITIONS VACANT

DIESEL POWER PLANT Layout Man needed immediately by Alaska Naval Air Base Contractors. Piping design experience necessary—location Seattle—contact Siems Drake Puget Sound, 2929 16th Ave., S.W., Seattle, Washington.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years' recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 270 Delward Bldg., Buffalo, N. Y.

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EXPEDITOR-LIAISON ENGINEER. Are deliveries holding -up your projects, preventing you from completing your program on schedule? My broad and varied experience negotiating with Sub-contractors and Suppliers regarding Contracts for heavy diversified Mining, Power Plant and Industrial Materials, Machinery and equipment, Expediting, Inspecting, and Testing in strict accordance with Drawings, Specifications, Shipping Instructions make my foresight, the ability "to get things done", of real value to an up-and-coming organization. Proven Executive Ability. Can install expediting department. Industrial Electrical Engineering graduate, Accountancy and Business Administration trained and experienced. Knowledge of Priorities, Personnel work. Practical knowledge shop practice, six years of drafting. Well traveled, Single, Christian, Citizen, Age 47. Minimum Salary $425 a month. P.O. Box 16, Station "P", New York, N. Y.

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Extremely competent engineer. Thirty years experience—power plant operation and maintenance. Combustion — refrigeration — heating specialist. Would like to take charge of utility or industrial plant on war work. Vicinity New York City or Connecticut.

PW-292, Power
330 West 42nd St., New York City

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Address

RW-287, Power
520 No. Michigan Ave., Chicago, Ill.

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For established line of scale and rust eliminants; includes treatments for boilers, engines and brine. On market for 16 years but still different than all other preparations. Exclusive arrangement on attractive commission basis.

Write giving detailed qualifications and territory regularly covered.

RW-276, Power
330 W. 42nd St., New York City

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Complete Plan Preparation—Specifications
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Layouts—Production Systems, etc.
Ample Facilities—Maintained Schedules

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Equipment Engineering Associates
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CONSULTING ELECTRICAL AND MECHANICAL ENGINEERS

Technical Advisers to the Purchasers of Used Steam and Electrical Equipment

Inspection Redesign Reports
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ADELBERT B. PRICE
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NEW & REBUILT automatic voltage regulators of all makes for all size DC and AC generators at money saving prices. Prompt shipments. Write your problems today. We buy and sell all kinds Electric Meters. Liberal allowance on your old regulator, meters.

Electrical Instrument Exchange
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WANTED

WE BUY FOR CASH

motors, generators, transformers, and oil circuit breakers.

ELECTRIC EQUIPMENT COMPANY
347 N. Clinton Ave., Rochester, N.Y.
Main 252-253

WANTED
GENERATOR SET

250 KW, 3 Phase, 60 Cycle, 220 V., 4 Wire. Engine must be upright.

QUICK SERVICE LDRY. #1 INC.
315 E. 99th St. New York City

WANTED
GAS ENGINE

1—90 H.P., 4 cylinder, 10 x 11 Bruce MacBeth gas engine, type serial number around 600-700. Reply

W-285, Power
330 West 42nd St., New York City

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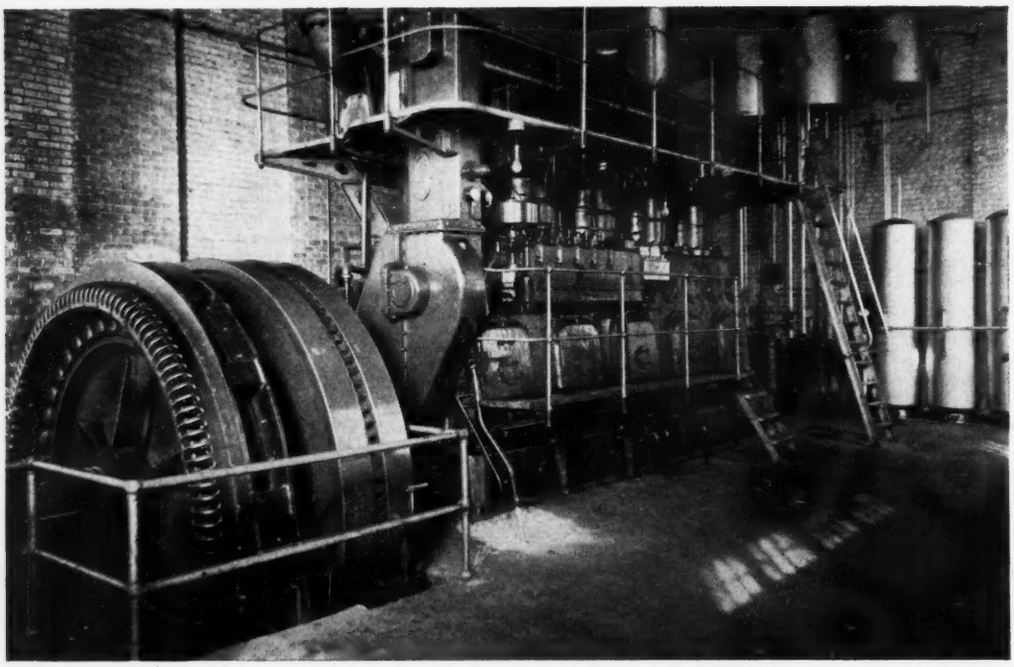

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800 KVA WESTINGHOUSE-DE LA VERGNE FULL DIESEL OIL ENGINE UNIT

800 KVA WESTINGHOUSE alternating current generator type ES 3 phase 60 cycle 600/2300 volts 180 RPM direct connected to 940 HP De La Vergne full diesel oil engine type I model VB 5 cylinder 180 RPM.

The above unit is complete with all accessories as in operation. Installed new 1932.

ALTERNATING CURRENT ENGINE GENERATORS

3 Phase 60 Cycle

625 KVA WESTINGHOUSE—Ames 4 cylinder vertical uniflow, 150-175 lbs. 0-5 lbs. back pressure, 2300 / 600 / 480/ 240 volts.

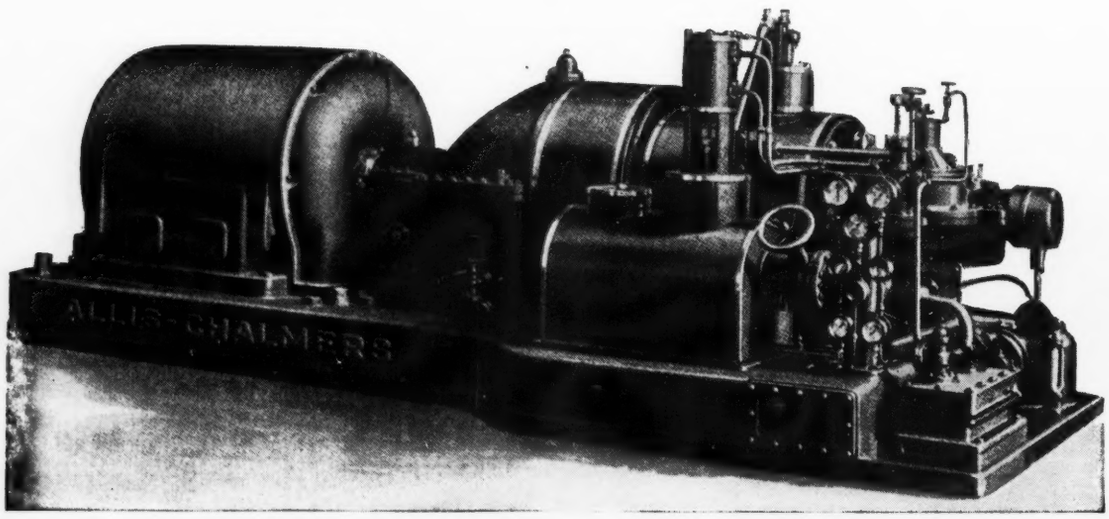
210 KVA GENERAL ELECTRIC—Ames Uniflow, 125-150 lbs. 0-5 lb. back pressure, 2300/600/480/240 volts.

DIRECT CURRENT ENGINE GENERATORS

125/250 Volts 3-Wire

150 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0-8 lbs. back pressure

125 KW CROCKER WHEELER—Ames 3 cylinder vertical Uniflow, 200-250 lbs. 0-8 lbs. back pressure



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1000 KW ALLIS CHALMERS CONDENSING TURBO UNIT

1000 KW 80% P.F. 1250 KVA Allis Chalmers alternating current generator 3 phase 60 cycle 2300 volts 3600 RPM direct connected to 1000 KW Allis Chalmers condensing turbine 150-200 lbs. steam pressure 100 deg. superheat. Equipped with jet condenser and auxiliaries.

THE NATIONAL POWER

WER EQUIPMENT

ROTARY CONVERTERS

60 Cycle

3500 KW (2) WESTINGHOUSE, 225-285 volts D.C., 225 RPM with 3 phase 60 cycle 13200 volt transformers

2500 KW WESTINGHOUSE, 600 volts D.C., 400 RPM with 3 phase 60 cycle 11000 volt transformers

1500 KW WESTINGHOUSE, 225-285 volts D.C., 450 RPM with 3 phase 60 cycle 2300/4000-6900/12000 volt transformers

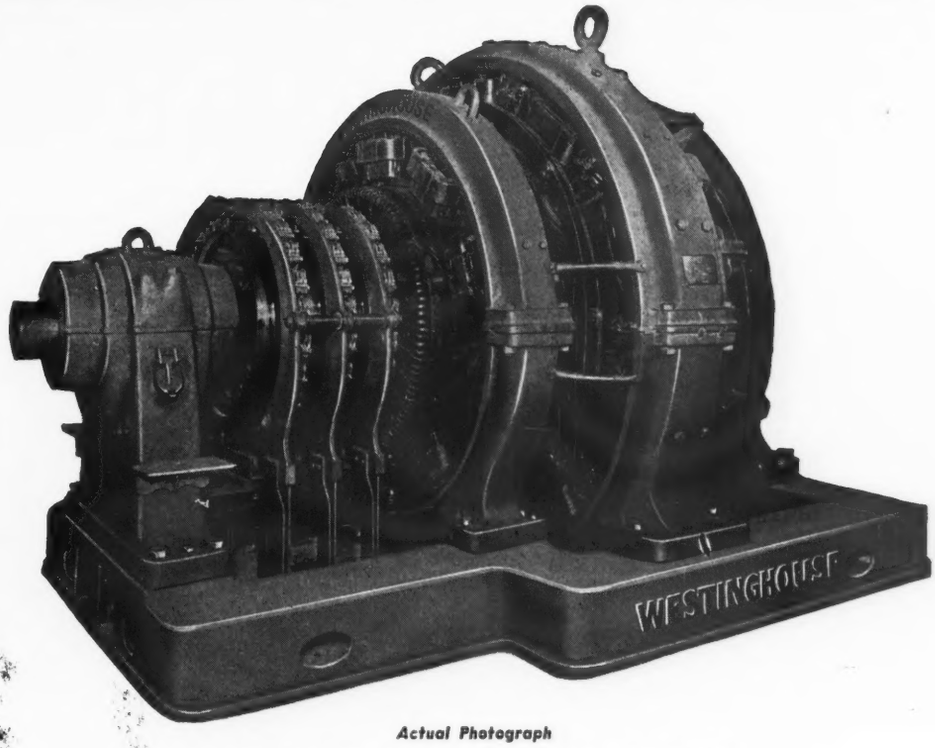
750 KW GENERAL ELECTRIC, 600 volts D.C., 1200 RPM with 3 phase 60 cycle 2300/4000 volt transformers

ROTARY CONVERTER

25 Cycle

2000 KW WESTINGHOUSE, 230-310 volts D.C. 300 RPM with 3 phase 25 cycle 4000 volt transformer

1500 KW WESTINGHOUSE, 600 volts D.C., 500 RPM with 3 phase 25 cycle 11000 volt transformer



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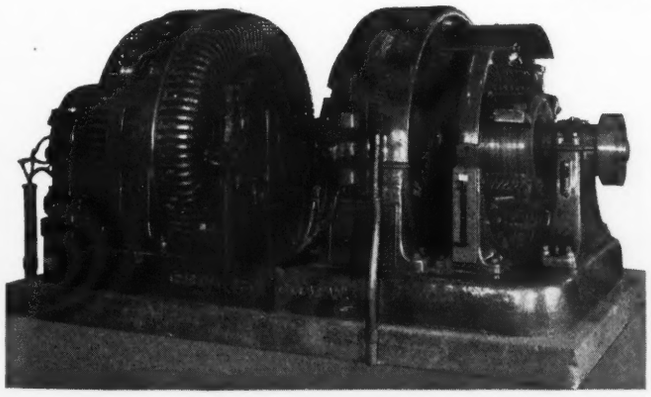
1500 KW WESTINGHOUSE ROTARY CONVERTER

1500 KW WESTINGHOUSE interpole rotary converter, 225/285 volts DC 450 RPM; 6 phase 60 cycle A.C. 2300/4000-6900/12000 volt transformers. Complete with control.

MOTOR GENERATOR SETS

3 Phase 60 Cycle



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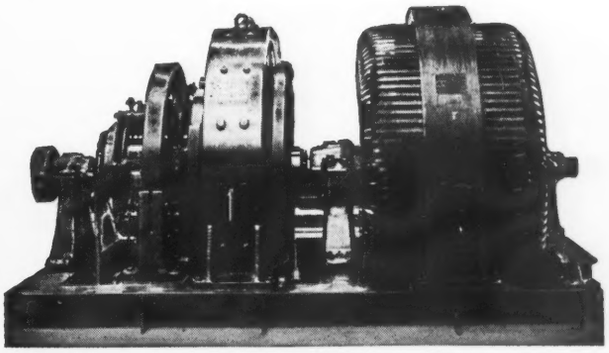
750 KW GENERAL ELECTRIC MOTOR GENERATOR SET

750 KW GENERAL ELECTRIC direct current generator, 600 volts 720 RPM direct connected to 1100 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.



Actual Photograph

1000 KW GENERAL ELECTRIC MOTOR GENERATOR SET

1000 KW GENERAL ELECTRIC direct current generator, 125/250 volts 3-wire 720 RPM direct connected to 1400 HP 80% P.F. General Electric synchronous motor 3 phase 60 cycle 13200/6600 volts 720 RPM. Equipped with D.C. breakers.

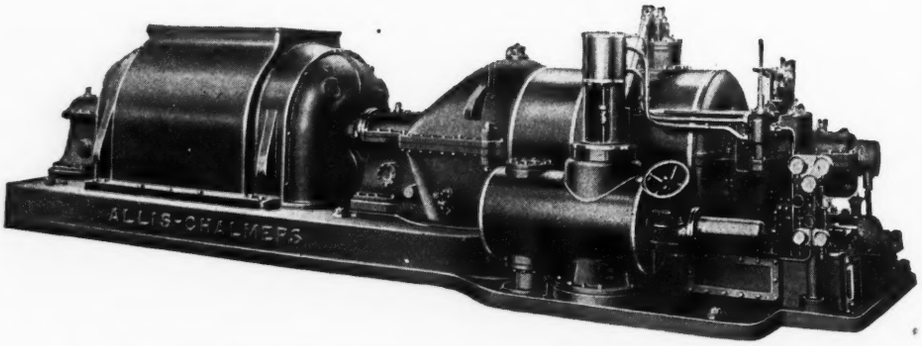
460 KW 3-unit 125/250 volt D.C. synchronous motor generator set, consisting of 2-230 KW General Electric direct current generators, 125 volts 720 RPM direct connected to 700 HP unity P.F. General Electric synchronous motor, 3 phase 60 cycle 4000/2300 volts 720 RPM. Equipped with D.C. control panel and starting equipment.

R MACHINERY CO. 1921 SCRANTON RD. CLEVELAND, OHIO

DEPENDABLE

Turbo-Generators

It is the Practice of this Company to Confine its Inventory Strictly to Comparatively Modern, Little Used Turbines Some Are Practically New



2—Allis-Chalmers, 2500-KVA, 3/60/2300-volt, 200#-P, 500°F-TT, Surface Condensers

PART OF OUR INVENTORY—BELOW

1—Westinghouse 6250-KVA, 3/60/2300-v, 200# 500°F. TT. Surface Condenser.

1—Allis-Chalmers 4000-KVA, 3/60/2300-v, 200#, 500°-F, TT, Condensing.

1—G.E., 2500-KVA, 3/60/600-v, 200# 500° F. TT. Condensing.

1—G.E., 1563-KVA, 3/60/2300-v, 175#, 100° SH, 28". Surface Condenser.

1—Westinghouse, 1563 KVA, 3/60/2400 volts, 200#, 100° SH. Condensing, Modern.

1—Westinghouse 1000-KW, 250-volt, Direct Current, Condensing, 150/200# pressure. Surface Condenser.

1—Allis-Chalmers 1250-KVA, 3/60/2300-v, 200#, 500° TT. Surface Condenser.

1—G.E., 1250-KVA, 3/60/480-v, 175#-P and 16# Abso. Mixed Pressure.

1—G.E., 937-KVA, 3/60/2300-v, 200#, 500°-TT, 3-Stage Condensing.

1—Allis-Chalmers, 937-KVA, 3/60/2300-v, 200#, 500°-TT, Condensing Surface Condenser.

1—G.E., 625-KVA, 3/60/2300-v, 200#, 500°TT. Condensing.

1—G.E., 625-KVA, 3/60/600-v, 250#, 550°F-TT, Condensing Modern.

WILMS, WEAVER & CO. Union Guardian Bldg. DETROIT, MICH.

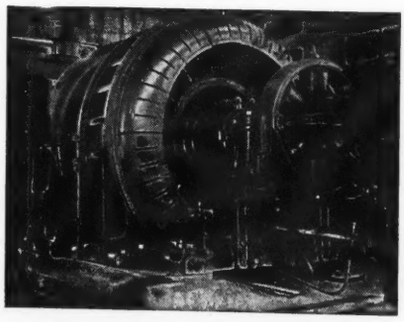
We Deal in Turbo-Generators Exclusively

"Convert . . . or else!" SAYS UNCLE SAM

Forced conversion of thousands of manufacturing plants to war production in 1942 is dead certain. Many readers of POWER will be directly affected, especially the plant engineer . . . When his factory "converts" to war work, as thousands will, the management will expect him to reach out into the thin air and gather all things needful to deliver enough air and steam and electricity and mechanical power to all the new productive machines in their new locations in buildings old and new.

from POWER

•Depend on "HEMPHILL" for the needed Power Equipment!



MOTOR GENERATOR SETS

1—500 KW, 650 volt, General Electric, syn.
1—100 KW, 125/250 volt, Allis Chalmers, squirrel cage.
1—50 KW, 250 volt, General Electric, sq. cg.
1—35 KW, 125 volt, El. Mach., sq. cg.
1—52½ KW 35 volt Westinghouse.
1—10 KW 125 volt Electric Machinery
1—16 KW 125/250 volt Westinghouse

D. C. GENERATORS

1—100 KW, 600 RPM, 125/250 volt, G.E.
1—75 KW, 260 RPM, 250 volt, Westinghouse.
2—32 KW, 650 RPM, 125 volt, Westinghouse.

MOTORS—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—500 HP, 450 RPM, 2200/4000 volt, G.E., slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., sl. rg.
1—350 HP, 300 RPM, 440 volt, G.E., slip ring.
1—350 HP, 100 RPM, 220/440 volt, G.E. syn.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—250 HP, 450 RPM, 220 volt, G.E., slip ring.
1—250 HP, 360 RPM, 440 volt, Westg. sq. cg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
1—200 HP, 600 RPM, 2200 volt, G. E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—200 HP, 514 RPM, 4000 volt, G.E., syn.
1—150 HP, 1800 RPM, 2300 volt, Allis Chal. sq. cg.
1—150 HP, 1200 RPM, 440 volt G.E. synch.
1—150 HP, 900 RPM, 440 volt, Allis Chal. sl. rg.
1—150 HP, 720 RPM, 440 volt, G E., slip ring.
1—150 HP, 600 RPM, 440 volt, G.E., slip ring.
1—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
2—125 HP, 720 RPM, 440 volt, G.E., slip ring.
2—125 HP, 450 RPM, 440 volt, G.E., syn.
1—100 HP, 900 RPM, 220 volt, G.E., sq. cg.
1—100 HP, 900 RPM, 440 volt, G.E., slip ring.
3—100 HP, 720 RPM, 440 volt, G.E., slip ring.
1—100 HP, 720 RPM, 440 volt, G E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., slip ring.

MOTORS—3 PHASE 60 CYCLE—(Continued)

1—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G. E., sq. cg.
1—75 HP, 1800 RPM, 220/440 v., G. E., sq. cg.

MOTORS—D. C. 230 VOLTS

1—125 HP, 850 RPM, G.E., type CD.
100 H.P. G. E. 575 RPM
1—65 HP, 1000 RPM, G. E., type RC.
1—50 HP, 1100 RPM, Crocker Wheeler.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
50 H.P. 750 RPM. G. E. CO1829
45 H.P. 1300 G. E. Type RC
1—40 HP, 1100 RPM, G.E., type RC.
1—40 HP, 300 RPM, General Electric.
1—30 HP, 750 RPM, G.E., type RC.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—75 HP, 235/950 RPM, Burke.
1—60 HP, 600/1200 RPM, General Electric.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—20 HP, 750/1500 RPM, General Electric.
1—5 HP, 600/1200 RPM, General Electric.
6—5 HP, 400/1200 RPM, Westinghouse.
1—5 HP, 225/900 RPM, Electro Dynamic.

ALTERNATORS

1—625 KVA, 450 RPM, 600 volt, Westg.
1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—375 KVA, 200 RPM, 240 volt, Elec. Mach.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—37½ KVA, 1200 RPM, 2400 volt, Westg.

TURBO-GENERATORS

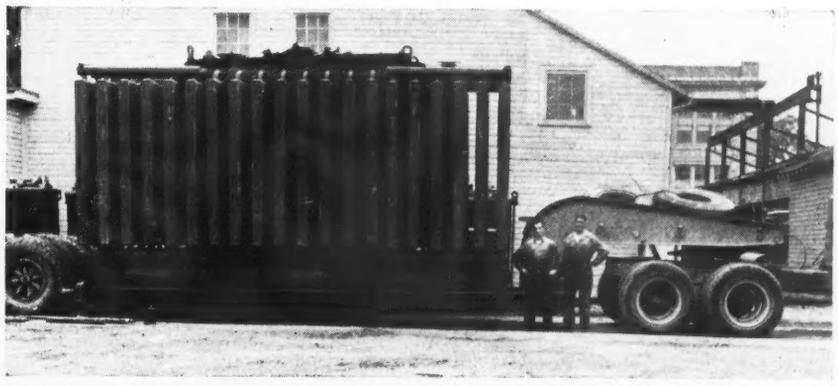
2—1000 KW, 3 ph., 60 cy., 2300/4150 v., cond.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v. cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps
3—300 KVA, Pittsburgh, 7800/440 volts.
1—200 KVA, Pittsburgh, 7800-110/220 volts
3—150 KVA, G.E., 33,000-2300/4000 Y
3—150 KVA, Pittsburgh, 6600/440 volts.
4—150 KVA, G.E., 3 ph., 4150-120/208 v.
3—125 KVA, General Electric, 2300/480.
3—100 KVA, Westinghouse, 13200 250 volts
1—75 KVA, Pittsburgh, 7600-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
4—50 KVA, Westg., air cooled, 440-220/220-110 v.
3—50 KVA, Westinghouse, 220-110/220 volts.
3—50 KVA, G.E., 2200-110/220 volts.
52—37½ KVA, 2200-220/110 v.
10—25 KVA, Westg., air cooled, 440/220-110 v.
3—25 KVA, Molcney, 2200-220/110 volts.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.
1—15 KVA, G.E., 440/110-220 volts.
4—10 KVA, G. E., 2300-115/230 volts.
3—7½ KVA, G.E., 440-110/220 volts.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—2000 amp., 15,000 v., 3 pole, G.E., type FK-53b.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1500 amp., 440 v., 3 pole, Condit, D12.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.



J. L. HEMPHILL & CO., INC., Power Equipment

New York Phone: LOngacre 5-3227 — 1602 53rd ST., NORTH BERGEN, N. J. — New Jersey Phone: UNion 3-2600

IMMEDIATE DELIVERY
GUARANTEED REBUILT POWER EQUIPMENT

SYNCHRONOUS MOTORS

HP	Make	Type	Volts	Speed
1050	GE	ATI	460	900
875	Wtg		440	240
800	Al. Ch.		2300	180
750	Wtg. (2)		4000/2300	1200
650	Al. Ch.		2300	1200
450	Wtg. (2)		4000/2300	1200
400	GE	TS	440/2300	360
225	GE	ATI	2400	720
200	Wtg.	HR	2200	225
190	Elec. Mhy (2)		440	740
190	Elec. Mhy (2)		220	514

SLIPRING MOTORS

HP	Make	Type	Volts	Speed
2850	Wtg.	CW	6600	450
1500	Allis. Chal.	ANY	2200	485
800	Wtg.	CW	6600	443
700	Allis. Chal.		440	354
600	G.E. (2)	IM	2300	770
500	G.E. (2)	IM	2200	600
350	G.E.	IM	2200	360
350	G.E.	MT	2300	300
300	G.E.	IM	440	300
300	Allis Chal		2300	300
300	G.E.	MT	2200	514
240	G.E.	MT	440	870
200	G.E. (2)	IL	440	600
225	G.E.	IM	440	600
200	Howell R. brg.		440	600
200	G.E.	IM	2200	600
200	Wtg.	CW	440	580
200	Wtg.	CW	440	345
150	Wagner	BR	440	1150
150	Al. Ch.	ANY	440	870
150	G.E.	MT	440	870
150	G.E.	IM	220	600
150	G.E.	IM	220	585
100	Wtg.	HF	440	230
125	G.E.	MT	440	720
75	Al. Chal.		2200	720
75	G.E.	MT	440	850
75	Allis Chal.	ARY	220	865

SQUIRREL CAGE

200	G.E.	KTP557	2200	1800
200	G.E.	IK	440	580
200	Wtg.	CS	440	580
200	Wtg.	CS	440	580
150	G.E.	IK	2200	1750
150	Wtg.	CS	2300	1175
150	Al. Ch.		440	1170
125	G.E.	IK	200	580
100	Wtg. (2)	CS	440	1160
100	Wtg.	CS	2200	1160
100	G.E.	IK	220	1200
100	G.E.	IK	440	900
75	G.E.	IK	2200	1700
100	Wagner	3ST3BM	2200	428
75	G.E. (5)	IK	220	600
60	Allis Chal	AR	440	3500
60	Wagner	VRB	220	1200
60	G.E.	IK	220	900
60	G.E.	IK	220	900
60	Wtg.	CS	220	435
50	Howell	FBB	220	1725
50	Watson	KH	440	1720
50	G.E.	KT	2200	870
50	G.E.	IK	440	490

MOTOR-GENERATOR SETS

750 KW Elliott 220 v DC. 440 v. syn.
500 KW GE 600 v DC 4400/2200 syn.
300 KW GE 3-unit 3-w 2200 v syn AC
300 KW GE 600 v DC 11000/2200 AC
225 KW Ideal 115 v DC 2200 v AC syn.
225 KW Wtg 115 v DC 2200 v AC syn.
150 KW GE 250 v DC 2200/220 syn.
150 KW GE 600 v DC 4000/2300 syn.
150 KW GE 250 v DC 2200/440 syn.
100 KW AC 125 v DC 440 v ind AC
100 KW GE 230 v DC 440 v syn AC
100 KW GE 250 v DC 2200 v ind AC
90 KW GE 250 v DC 220 ind AC
75 KW GE 125 v DC 220 syn AC
75 KW GE 125 v DC 220/440 ind AC
75 KW GE 125 v DC 220 v AC ind.
90 HP Wtg. 110 v DC 2200 AC gen
50 KW AC 125 v DC 2200 v ind AC
50 KW GE 125 v DC 4000/2200 ind AC
50 KW AC 125 v DC ind AC
33 KW Diehl 110 v DC 220 syn AC

FREQUENCY CHANGERS

500 KVA Westinghouse with 583 HP 3/25/2200/575/440/220 v. 750 RPM syn. motor 500 KVA 3/62½ cy. 2300/440/220 syn. gen. both machines amortisseur equipped, can be operated from 60 cy. to furnish 24 cy.

BOILER FEED PUMP

Worthington size 12 x 7½ x 15 300# water press. 175# steam, duplex plunger type.

SPECIAL MOTOR

1—25/65 HP Wtg. oil well type 3/60/440 volts, 570/1160 RPM, style 88C138, with control, real bargain.

SYNCHRONOUS CONDENSERS
3 ph. 60 cy.

1000 HP Wtg. 3/60/440 volts 900 RPM
2000 HP GE ATI 3/60/11000 v. 600 RPM

ENGINES

500 KW GE MPC 250 volts DC generator, with Skinner uniflow engine.
500 HP Winton gas engine 8-cylinder overhead valve type, can furnish with AC generator.
125 hp. Waukesha gas engine, AC Gen.
165 hy. Hope gas engine, AC driven.

ROTARY CONVERTER

200 KW Gen. Elec. 125/250 volts DC 6 phase 60 cycle, 440 volts AC with switchgear and transformer equipment.
500 KW GE 240/275 volts DC 6 phase 60 cycle, 2200/4000Y AC, with switchgear and transformer equipment.

25 Cy. M.G.'s,

75 KW GE 125 v DC 3/25/440 AC 750 RPM interpole.
75 KW GE 125 V. DC 3/25/220 v 750 RPM 2-brg.

AC GENERATORS

KVA	Make	Type	Volts	Speed
187	GE	ATB	2300	600
175	Wtg.		2200	900
150	West Elec	S15C	230	900
125	Wtg.		2400	900
25	Cr. Wh.		240	1800
10	Cr. Wh.		240	1800
4	GE	1 ph 14½ cy	110	860
1.2 KW	GE	1 ph 14½ cy	110	860

TRANSFORMERS

2—5000 KVA 3/60/OISC 13800 pri 2300 v sec.
3—750 KVA GE 1/60/13890 pri 2200 v sec.
4—250 Wtg. 13800 to 2300/4000 v.
2—100 KVA GE 1/60 4600 to 120/240 v sec.
9—75 KVA Wtg. 1/60 3810 pri 240/122 sec.

WRITE FOR YOUR FREE COPY OF COMPLETE STOCK CATALOG

CHICAGO ELECTRIC CO.

1320 W. 22ND ST.
CHICAGO, ILLINOIS

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE—60 CYCLE 220/400 VOLT

H.P.	Make	RPM	Type	Frame
15	Allis-Chalm.	1750	2K54411	
20	Gen. Elec.	1750	KT	753
20	Gen. Elec.	600	I	K
25	Burke	900	EM	
40	Gen. Elec.	900	KT	336
40	Burke	1200	EM	45
40	Westing.	1750	CS	
50	Westing.	900	CS	
50	Gen. Elec.	900	KT	542
60	Burke	900	EM	7
60	Gen. Elec.	1200	I	K
60	Gen. Elec.	1800	I	K
75	Gen. Elec.	1200	KT	343
75	Gen. Elec.	1200	I	K
75	Gen. Elec.	1800	I	K
75	Gen. Elec.	900	I	K
100	Gen. Elec.	1750	I	K
100	Westing.	900	CS	
100	Lincoln	1200		
150	Gen. Elec.	1200	I	
150	Westing.	900	CS	
200	Gen. Elec.	600	I	K
200	Gen. Elec.	720	I	K
200	Gen. Elec.	900	I	K
200	Gen. Elec.	1200	I	K
250	Gen. Elec.	600	I	K
250	Gen. Elec.	720	I	K
250	Allis-Chalm.	900		
300	Gen. Elec.	720	I	K

Compressors in stock up to 300 H.P. Compensators.

MOTOR GENERATOR SETS

1—100 KW. Crocker Wheeler 250 v DC 500 RPM direct connected to 150 HP General Electric Motor 3 PH 25 cycle 2200 volts 500 RPM. complete.

1—35 KW Westinghouse Generator 125 volt DC 1450 RPM direct connected to 53 HP West. CS motor 3 ph. 25 cy. 220 v. 1450 RPM. complete.

1—75 KW Ridgeway 140 v DC 1200 RPM direct connected to 120 HP Ridgeway synchronous motor 3/2200/60/1200 RPM. Complete.

3—100 KW Ridgeway sets 250 v. DC. 1200 RPM direct connected to 150 HP. Ridgeway synchronous motors. 3/2200/60/1200 complete with panels.

DIRECT CONNECTED PUMPS

1—280 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 3 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

2—400 G.P.M. Buffalo Pumps, Inc. 30 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

3—350 G.P.M. Buffalo Pumps, Inc. 40 ft. head direct connected to 5 HP. Westinghouse splash proof motor, 3 phase, 25 cycle, 1450 rpm.

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltage
3	40	G. E.	25	2200/440
3	50	Whse.	25	2200/110/220
3	50	Whse.	25	11000/2200
3	100	Whse.	60	2200/220/440
3	100	Whse.	60	4600/230/460
3	100	G. E.	25	2200/220/440
3	100	G. E.	25	11000/2200
3	200	G. E.	60	2400/220/440
3	200	G. E.	60	4600/230/460
3	200	G. E.	60	6600/220/440
3	500	Pitts.	25	11500/100
3	1000	Pitts.	60	2300/4600/230/460

FREQUENCY CHANGES

94 KVA Westinghouse Synchronious Set Generator, 62½ cy., 230 v., 750 RPM with panels. Motor 112 HP. 3/25/2300/750 Synchronous with starting equipment.

1—120 KVA Gen. Elect. Induction Frequency changer, 440 volts 3 ph. 62½ cy. Driving motor 100 HP. 3 PH. 440 volt 25 cycle 720 RPM. Complete.

SPECIAL MOTORS

1100 H.P. General Electric Synchronous Motor, 3 ph., 25 cy., 11,500/6600/2200 V., 375 RPM

1—500 H.P. Gen. Elect. Sync. 3/2200/60/1200 R.P.M. with Exciter. New.

500 H.P. Allis-Chalmers, 3 ph., 25 cy., 440 V., 490 R.P.M., Complete.

300 H.P. G.E. Slipring, 25 cy., 3 ph., 2200 V., 500 RPM, 3 bearing; complete with controls.

225 H.P. Electric Mchy. Co. Synchronous, 3 ph., 25 cy., 2200 V., 500 R.P.M. with controls.

1—100 H.P. G.E. Synch. Motors, 3 ph., 25 cy., 220/440 V., with control equipment.

SLIPRING MOTORS
60 CYCLE, 3 PHASE, 220/440 VOLTS

H.P.	Make	Type	Frame	RPM
300	Gen. Elec.	I	Form M	1185
75	Gen. Elec.	MT	537	1800
60	Gen. Elec.	MT	353	1800
60	Gen. Elec. (2)	MT	353	720
50	West.	CW	654C	1800
50	West.	CW	644C	900
50	West.	CW	654C	1800
40	Wagner	22WB		540
40	West.	CW	748	690
40	West.	CW	748	690
40	West.	CW	748	690
30	West.	HF	8B	1745
30	Gen. Elec.	MTC		1725
25	Gen. Elec.	MT	513	1800
25	Gen. Elec.	I	M	1200
25	West.	CW	750C	575
20	West.	CW	648A	575
20	West.	CW	644C	575
20	Gen. Elec.	MT	332	545
20	West.	CW	748A	575
20	West.	CW	748A	575
20	West	CW	748A	575
15	Gen. Elec.	I-M		1725
15	Gen. Elec.	ITC		1725
10	Gen. Elec.	MT		1725

25 CYCLE, 3 PHASE, 440 VOLTS

H.P.	Make	Type	Serial	RPM
150	Gen. Elec.	MT563Y	5056230	725
125	Gen. Elec.	I-17	4550934	360
50	Gen. Elec.	MT547	5264084	720
50	Gen. Elec.	MT353	3879210	750
50	Allis-Chal.		7923K	715
52	Gen. Elec.	ITC5013	1773223	700
40	Gen. Elec.	MT543	4917983	750
40	Gen. Elec.	MT343	3887755	750

25 CYCLE HOIST

1—350 lb. capacity Shaw Box Load Lifter Jr. motor 3/440/25 cycle. 18 ft. lift. 32 ft. per minute.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

POWER PLANT MACHINERY

Available Immediate Delivery

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA Westinghouse condensing 175-200 lb. pressure, 2300 volts, complete with surface condenser and auxiliaries.

1875 KVA G.E. condensing 225 lb. pressure, 600° T.T. 2300 volts, 3600 RPM, complete with condenser.

1563 KVA G.E. condensing 175-200 lb. pressure, 500° T.T., 2300 volts, 3600 RPM, complete with surface condenser and condensing auxiliaries.

1250 KVA ALLIS condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with Wheeler surface condenser.

937 KVA G.E. condensing 200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with Ingersoll-Rand condenser, exciter, switchboard and instruments.

937 KVA Westinghouse automatic extraction condensing, 150-200 lb. pressure, 10 lb. bleeder, 480 volts, 3600 RPM, complete with direct connected exciter and switchboard.

937 KVA ALLIS condensing 200 lb. pressure, 100° SH, 2300-550-480 volts, 3600 RPM complete surface condenser with auxiliaries, direct connected exciter—Modern and practically new.

937 KVA ALLIS condensing 150 to 200 lb. pressure, 475° TT, 2300 volts, 3600 RPM, complete with direct connected exciter, surface condenser and auxiliaries.

750 KVA G.E. condensing, 150-200 lb. pressure, 2300 volts, 3600 RPM, complete surface condenser and exciter set.

625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM, complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° superheat, 2300 volts, 3600 RPM, complete with surface condenser auxiliaries.

MOTOR GENERATOR SETS

1500 KW ALLIS 600 volt direct current generator direct connected to a 2190 HP, 3 phase, 60 cycle, 4000 volt, 300 RPM synchronous motor.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle—Alternating Current

1125 KVA G.E. 480 volts, 150 RPM direct connected 24"x46"x33" Erie-Ball cross compound engine, complete exciter, and rheostats.

1000 KVA G.E. 480 volts, 150 RPM direct connected 31"x36" Skinner Unaflow engine, complete exciter, switchboard panel and instruments.

500 KVA G.E., 240/480 volts, 150 RPM direct connected 26"x32" Skinner Universal Unaflow non-condensing engine, 130-160 lb., 6 lb. back pressure, complete exciter and rheostats.

500 KVA G.E. 240 volts, 120 RPM direct connected 20"x42" Rice Sargent Corliss non-condensing engine, 125-150 lb., 10 lb. back pressure.

312 KVA G.E. 240 volts, 200 RPM direct connected to 21" x 24" Skinner Unaflow engine complete exciter, switchboard panel and instruments.

100 KVA WESTINGHOUSE, 240 volts, 277 RPM direct connected 14"x14" Ames Unaflow engine, 125-150 lb. pressure, 5 lb. back pressure.

ENGINE-GENERATOR UNITS

Direct Current

500 KW G.E. 250 volts, 150 RPM direct connected 26"x36" Skinner Universal Unaflow non-condensing engine.

300 KW WESTINGHOUSE 250 volts, 175 RPM direct connected 24"x26" Skinner Unaflow non-condensing engine, 110-150 lb. pressure, 5 lb. back pressure, complete switchboard and instruments.

250 KW Westinghouse 1000 amperes, 250 volts, 200 RPM direct connected 23"x24" Ames Unaflow engine, 125-150 lb. pressure, complete switchboard and instruments.

MOTORS

3 phase, 60 cycle

875 HP, WESTGH. 440 V., 240 RPM synchronous.

620 HP G.E. type ATI, form S, 440 volt, 164 RPM synchronous.

400 HP, G.E. type TS, Form AL, 440 V. 300 RPM synchronous.

400 HP, WESTINGHOUSE type CW, 440 V., 500 RPM, slip ring.

300 HP, 80% P.F. WESTINGHOUSE 2300 V., 200 RPM synchronous.

MOTORS (Con't)

3 phase, 60 cycle

250 HP, ALLIS-CHALMERS 440 V., 600 RPM synchronous.

200 HP, G.E. 2200 volt, 435 RPM slip ring.

150 HP (7) G.E. 2200 volts, 300 RPM slip ring.

150 HP (2) G.E. 440 volts, 1800 RPM squirrel case.

125 HP, (3) 80% P.F. Elec. Mchy. 440 V., 400 RPM synchronous with starting equipment.

125 HP, 80% P.F. Elec. Mchy. 440 V., 514 RPM synchronous.

100 HP G.E. 2200 volts, 900 RPM slip ring.

50 HP, type I, form M, 3 phase, 60 cycle, 2200 volts, 1200 RPM slip ring.

50 HP, (2) G.E. form K, 220 V., 900 RPM squirrel cage.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

MISCELLANEOUS

250 KW CROCKER-WHEELER 250 volt, 600 RPM compound wound interpole direct current generator.

1500 KVA, 3 phase, 60 cycle, 22,000 volt primary, 2300 volt secondary WESTINGHOUSE transformer.

900 KW G.E. 3 phase, 60 cycle, 480 volt, 150 RPM alternating current generator with exciter.

500 KVA IDEAL, 3 phase, 60 cycle, 240 volts, 400 RPM, three-bearing belted type generator with direct connected exciter and rheostats.

312 KVA WESTINGHOUSE, 3 phase, 60 cycle, 2300 or 220 volts, 200 RPM, engine type generator with belt driven exciter and rheostats.

200 KVA WESTINGHOUSE, 3 phase, 60 cycle, 240 volts, 200 RPM engine type generator with rheostat.

1 ELLIOTT EHRHART jet condenser with all auxiliaries suitable for operation with a 5000 KW turbine-generator unit.

1500 sq. ft. WESTINGHOUSE surface condenser.

1055 cubic feet, 100 lb. air pressure CHICAGO PNEUMATIC horizontal compressor direct connected to 170 HP, 240 V., 150 RPM General Electric direct current motor.

SPECIAL

1—PRACTICALLY NEW WESTINGHOUSE FREQUENCY CHANGER SET CONSISTING OF:
655 HP, 3 phase, 25 cycle, 2200 volts, 300 RPM synchronous motor direct connected to 565 KVA 80% P.F., 3 phase, 60 cycle, 240 volt, alternating current generator complete and equipped with direct connected exciters, all panels with instruments.

Utilities Electrical Machinery Corporation
600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO
WIRE OR PHONE
LONG DISTANCE 422

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.
1—12000 KW General Electric Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 2850 KVA Westinghouse Cond.
1— 2500 KVA General Electric Cond.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 750 KVA Terry Double Extr. Cond.
1— 375 KVA General Electric Cond.
1— 250 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C
1— 375 KVA General Electric Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.
1—1067 KVA Nordberg Uniflow
2— 937 KVA Nordberg Uniflow
1— 500 KVA Rice & Sargent Corliss
1— 375 KVA Erie City Slide Valve
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 250 KVA Harrisburg Uniflow
1— 250 KVA Erie City Slide Valve
1— 150 KVA Hamilton Poppet Valve

DC STEAM ENGINE UNITS
1—500 KW Skinner Uniflow 250 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—300 KW Erie City 4-valve 250 V.
1—200 KW Chuse 4-valve 250 V.
1—200 KW Skinner Uniflow 250 V.
1—150 KW Erie Ball 4-valve 250 V.
1—150 KW Ames Uniflow 125 V.
1—100 KW Ames Uniflow 120 V.
1— 75 KW Skinner Uniflow 250 V.
1— 50 KW Ames Uniflow 125/250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.
1—603 KVA Fair.-Morse 480 V.
1—400 KW West. (gas) 440 V.
1—375 KVA Ing.-Rand. 2300/440/220 V
1—237 KVA Fair.-Morse 480 V.
1—93.5 KVA Anderson 2300 V.
1— 75 KVA Fair.-Morse 2300 V.
1— 40 KVA Fair.-Morse 2300 V.

WATER TUBE BOILERS
4—750 HP Edge Moor 200-lb.
6—600 HP Stirling 180-lb. Stokers
2—520 HP Heine 200-lb. Hand Fired
2—490 HP Stirling 200-lb.
2—407 HP Erie City 250-lb. Stokers
1—400 HP Stirling 200-lb.
2—360 HP Erie City 160-lb. Pulverized Coal
2—357 HP Casey-Hedges 175-lb. Stokers
2—350 HP Stirling 200-lb.
2—302 HP B. & W. 160-lb. Hand Fired
2—282 HP Edge Moor 200-lb. Stokers
2—270 HP Erie City 180-lb. Pulverized Coal
2—160 HP Stirling 155-lb. Hand Fired

SYNCHRONOUS MOTORS—60 Cy.
2—800 HP Electric Machy. 6600 V. 450 RPM
1—175 HP General Electric 440 V. 400 RPM
1—175 HP General Electric 230 V. 225 RPM
1—150 HP General Electric 440 V. 164 RPM
2—120 HP General Electric 440 V. 400 RPM
1—100 HP General Electric 4000 V. 900 RPM

INDUCTION MOTORS—60 Cy.
2—400 HP G. E. slip ring 3800 V. 1800 RPM
1—350 HP G. E. sq. cage 4000 V. 900 RPM
2—300 HP G. E. sq. cage 440 V. 600 RPM
2—250 HP G. E. sq. cage 4000 V. 1200 RPM
5—150 HP West. sq. cage 440 V. 900 RPM

AIR COMPRESSORS
1—3500 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—3300 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2600 Ft. 100-lb. Ing. PRE2, 60 cy. motor
1—2100 Ft. 65-lb. Worth. 60 cy. motor
1—1300 Ft. 100-lb. Sullivan Diesel
1—1200 Ft. 100-lb. Ing. 2-stage, belt driven
1—1052 Ft. 100-lb. Ing. XRE. 60 cy. motor
2— 600 Ft. 100-lb. Ing. POC2, Diesel

OIL CIRCUIT BREAKERS
1— 800 A. 87 KV Am.Br. Bov. AF22 Outdoor
2— 600 A. 73 KV West. G222AS Outdoor
1— 400 A. 73 KV G. E. FKO36 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB-76 Outdoor
2— 600 A. 30 KV Kelman CB-76 Outdoor
1— 400 A. 25 KV G. E. FKO136 Outdoor
2— 600 A. 15 KV Kelman CB-76 Outdoor
1— 400 A. 15 KV G. E. FKO37 Outdoor

FREQUENCY CHANGERS
2—3125 KVA West. 25/62½ cy. 750 RPM
1—3000 KVA West. 60/25 cy. 300 RPM
1—2500 KVA West. 25/60 cy. 300 RPM
1—1500 KW G. E. 25/60 cy. 300 RPM
1—1250 KVA G. E. 25/62½ cy. 375 RPM
1—1000 KVA G. E. 60/25 cy. 514 RPM
2— 750 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA G. E. 25/60 cy. 300 RPM

ROTARY CONVERTERS—60 Cy.
1—1250 KW General Electric, 240 V.
2—1000 KW General Electric, 600 V.
1— 500 KW General Electric, 250 V.
1— 500 KW General Electric, 600 V.
2— 300 KW General Electric, 600 V.

SYNCHRONOUS CONDENSERS
1—4000 KVA G. E. 13200 V. 514 RPM
1—2000 KVA G. E. 11000/2200 V. 720 RPM
1—2000 KVA C. W. 11000 V. 60 RPM
1—1000 KVA G. E. 2300 V. 900 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.
3— 600 KVA West. 120,000/2300 V.
1— 5000 KVA Allis 72000/6600 V. 3 ph.
2— 1000 KVA West. 66000/2300 V.
3— 1000 KVA Wagner 33000/2300 V.
3— 500 KVA Allis 33000/480 V.
4— 200 KVA G. E. 33000/6600 V.
2— 100 KVA G. E. 23000-11500/575 V.
3— 100 KVA G. E. 22000/6900 V.
3— 100 KVA Allis 22000/440 V.
1—10000 KVA Pitts. 13200/4600 V. 3 ph.
2— 5000 KVA American 13800/2300 V.
5— 1000 KVA G. E. 13800/2300 V.
1— 450 KVA G. E. 13200/240 V. 3 ph.
3— 150 KVA Pitts. 13800/230-460 V.
3— 75 KVA West. 13800/230-460 V.
3— 1000 KVA Packard 11000/2300-4000 V.
3— 150 KVA Pitts. 11000/2400 V.
3— 100 KVA West. 11000/250-125 V.
1— 3300 KVA G. E. 6600/110 V. 3 ph. Furnace
3— 1250 KVA G. E. 6600/550 V.
1— 1500 KVA West. 6600/106 V. 3 ph. Furnace
3— 100 KVA G. E. 6900/440-220 V.
3— 833 KVA Penn. 4800/120-240 V.
3—1000 KVA Pitts. 2300-4600/550 V.
4— 150 KVA G. E. 2300/115-230 V.
3— 100 KVA West. 2400/120-240 V.

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5000 KVA G.E. 2300/4000 V., Cond.
1250 KVA (2) G.E. 2300/4000 V., with surface Condensor.
937 KVA G.E. 2300/600 V., Non-Cond.
937 KVA G.E. 2300 V., with Surface Condensor.
937 KVA A1. Chal.—Elliott, 480/240 V., cond. or mixed pressure; with Jet Condensor, etc.
780 KVA A1. Chal. 2300 V., with Surface Condensor, Rado-Air Ejectors, etc. NEW, never in service.
625 KVA Wghse, 2300 V., with Surface Condensor, etc.
625 KVA A1. Chal. 2 ph., 2400 V; Jet Condensor, etc.
625 KVA GE. 2300 V.; Bleeder; Condensor.
625 KVA A1. Chal.—Elliott, 240/480 V., Automatic Bleeder, with Jet or Surface Condensor.
625 KVA Wghse. 2400 V., with Jet Condensor, etc.
375 KVA G.E. 2300 V., non-cond.
375 KVA A1 Chal. 2 ph., 2400 V., with Jet Condensor.
375 KVA G.E. 2300 V., Bleeder, with Jet Condensor.
312 KVA Ridgeway-Elliot 480/240 V., with Jet Condensor.
150 KVA Wghse. 240/480 V., Jet Condensor.

AC ENGINE UNITS

450 KVA Wghse. 18x36 Filer Stowell Corliss
375 KVA G.E. 22x27 Erie Ball 4 V.
312 KVA Elec. Mchy. 20x24 Chuse Uniflow
312 KVA Wghse. 21x22 Skinner Uniflow
300 KVA G.E. 18x36 Murray Corliss
250 KVA G.E. 18x42 Hewes-Philips Corliss
250 KVA G.E. 17x20 Erie Ball 4 V.
200 KVA G.E. 21x22 Skinner Uniflow
200 KVA A1. Chal. 14x36 A1. Chal. Corliss
125 KVA G.E. 14x15 Skinner Uniflow
112 KVA G.E. 14x18 Erie Ball 4 V.
100 KVA G.E. 14x16 Skinner Uniflow
60 KVA G.E. 12x12 Skinner Uniflow

DIRECT CURRENT UNITS

KW	Gen.	Volts	Engine
1000	Al. Chal.	250	Al. Chal.
500	C.W.	250	Hamilton Unif.
300	G.E.	250	Skinner Unif.
300	Wghse.	250	Murray Corliss
200	Wghse.	250	Turbine
200	G.E.	250	Skinner Unif.
200	G.E.	125	Erie Ball 4 V.
150	C.W.	125	Erie Ball 4 V.
150	G.E.	250	Erie Ball 4 V.
125	G.E.	250/125	Erie Ball 4 V.
100	C.W.	250	Erie Ball 4 V.
100	G.E.	125	Erie Ball 4 V.

BLEEDER TURBINE UNIT
625 KVA Allis Chalmers-Elliott 3 ph. 60 cy. 240/480 v.; automatic bleeder; with jet or surface condensor

BOILERS (ASME)

950 HP Sterling, 270#
728 HP E.C. Vert. 200#
685 HP Sterling 200#
650 HP Babcock & Wilcox 225#
500 HP (2) Heine bent tube 160#
500 HP Murray (Heine) 200#
484 HP Springfield Cross Drum 200#
471 HP Erie City Vert. 200#
451 HP Babcock & Wilcox, 160#
420 HP Sterling, 200#
320 HP Sterling, 200#
302 HP Babcock & Wilcox, 200#
300 HP Heine 175#
295 HP (3) Sterling, 200#
290 HP Connolly, sectional header, 220#
253 HP (2) Heine, 160#—cross drum

TRANSFORMERS

2—687 KVA Maloney 13,800/460 V.
2—500 KVA Maloney 2200/220 V.
3—333 KVA G. E. 11,000/440 V.
6—300 KVA Pittsburgh 22,000-2200/440 V.
4—200 KVA Wghse. 13,200-2300/4000 V.
3—200 KVA G.E. 22,000-220/6600 V.
3—150 KVA Wghse. 11,000/440 V.
3—150 KVA G.E. 13,200-115/230 V.
3—100 KVA G.E. 13,200/2300 V.
3—100 KVA Al. Chal. 22,000/440 V.
3—100 KVA G.E. 13,200/6600/2300 V.
3—100 G.E. 13,200/460-2300/4000 V.
3—75 KVA Wghse. 11,000/440 V.
3—75 KVA G.E. 13,200-115/230 V.
4—50 KVA Wghse. 2200-220/440 V.
3—37½ KVA Wghse. 2300/575 V.

GAS & DIESEL UNITS

1000 KVA G.E. 3 ph. 60 cy.; with Cooper Bessemer Nat. Gas. Engine
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200 KVA G.E. 3 ph. 60 cy.; Busch Sulzer Diesel.
168 KVA Ideal 3 ph. 60 cy.; Fulton 3 cyl. Diesel Engine; dir. con. exciter

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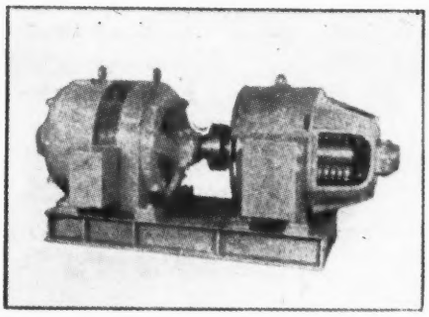

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MOTOR 235 KVA 3 ph. 60 cy. 4150 V 1200 R.P.M.

GENERATOR 200 KW 1200 R.P.M. cpd. INTERPOLE 250 V.

Complete AC and DC Control Eqpt.

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100 KW SKINNER UNAFLOW 150#, 250 R.P.M. Direct Connected to 115 Volt WEST. Generator cpd. Interpole

80 H.P. CHANDLER & TAYLOR 13 x 16—200 R.P.M. 100# pressure

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2400—110/220

7—25 KVA G.E.
2—15 KVA G.E.
5—10 KVA G.E.
1— 5 KVA G.E.

AC GENERATORS

50 KVA West. 1200 R.P.M.
40 KW G.E. 1200 R.P.M.

MOTORS

150 H.P. G.E. sq. cage 1800 R.P.M.
125 H.P. G.E. BTS 1150 R.P.M.
100 H.P. G.E. slip ring 900 R.P.M.
100 H.P. G.E. sq. cage 1800 R.P.M.
80 H.P. G.E. slip ring 1200 R.P.M.
60 H.P. G.E. slip ring 720 R.P.M.
50 H.P. G.E. sq. cage 1200 R.P.M.
5 H.P. G.E. slip ring 1200 R.P.M.

DC MOTORS

100 H.P. N.W. 1800 R.P.M.
15 H.P. G.E. 900 R.P.M.
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2—Bailey boiler meters

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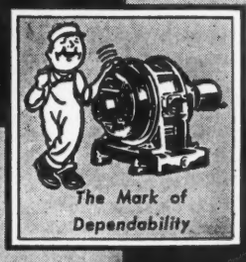

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200 H.P. G.E. TS 514 RPM.
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2—125 H.P. G.E. 720 RPM
112 H.P. G.E. hoist 720 RPM
100 H.P. Fairbanks Morse 720 RPM
100 H.P. Allis Chalmers 720 RPM
100 H.P. Westinghouse 720 RPM
75 H.P. Westinghouse 1200 RPM
75 H.P. Allis Chalmers 600 RPM
75 H.P. G.E., 600 RPM.
60 H.P. Westinghouse 1200 RPM
60 H.P. General Electric 1200 RPM
60 H.P. General Electric 900 RPM
60 H.P. West., 290 RPM.

SQUIRREL CAGE MOTORS
200 H.P. Allis Chalmers 1800 RPM
200 H.P. Allis Chalmers 1200 RPM
200 H.P. General Electric 600 RPM
150 H.P. Al. Ch., 1760 RPM.
150 H.P. F.M., 1800 RPM.
150 H.P. West., 1800 RPM (2).
100 H.P. G.E., 720 RPM.
75 H.P. Westinghouse 900 RPM
75 H.P. Burke, 1200 RPM.
75 H.P. Crocker Wh., 1200 RPM.
75 H.P. Allis Ch., 900 RPM.
60 H.P. G.E., 1800 RPM.
50 H.P. G.E., 900 RPM.
50 H.P. West., 900 RPM.
50 H.P. Allis Ch., 720 RPM.
50 H.P. G.E., 720 RPM.
50 H.P. G.E., 600 RPM.

A.C. GENERATORS
200 K.W. General Electric 600 RPM
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125 KVA G.E. 900 RPM
100 KVA West., 600 RPM.
100 KVA Crocker Wheeler 900 RPM
100 KVA Elec. Machy. 1200 RPM
90 KW GE 900 RPM
75 KVA G.E. 1200 RPM
30 KW G.E. 1200 RPM
15, 20, & 25 KVA 1200 RPM (8)

200 K.W. Elect. Machy. Syn.
MOTOR GENERATOR SET
Motor: 300 H.P., 3 ph. 60 cy., 4000 V, 900 R.P.M.
Gen.: 200 KW, 250 V, 900 R.P.M. Complete A.C. and D.C. Control Equipment.

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2 to 40 K.W. 600 to 2000 V. M.G. Sets (11)
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12½ x 390' Amer. Air Comp.

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12½x12 American Compressor, 390 ft. at 125 lbs. pressure.
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75 K.W. Westingh. Syn. Motor
40 K.W. Westinghouse
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165 H.P. Cr. Wheeler, 670 RPM.
75 H.P. General Electric 850 RPM
60 H.P. Sprague 900 RPM
60 H.P. G.E. 1000 RPM
60 H.P. Roth 600 RPM
50 H.P. G.E. 850 RPM
50 H.P. G.E., 1150 RPM.
40 H.P. G.E., 1700 RPM.
40 H.P. Allis Ch., 1150 RPM.
40 H.P. West., 1150 RPM.
40 H.P. Reliance 625 RPM
25 H.P. G.E., 1150 RPM (3).
25 H.P. West., 850 RPM (2).
25 H.P. G.E., 575 RPM.
20 H.P. G.E., 1750 RPM.

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35 H.P. West., 400/1200 RPM.
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27 H.P. G.E., CO-2002.
25 H.P. G.E. CD 600/1200 RPM
15 H.P. G.E. RF 400/1200 RPM
15 H.P. West. .825/1650 RPM
15 H.P. G.E. 600/1800 RPM
15 H.P. Electro Dyn. 450/1350 RPM

115 VOLT D.C. MOTORS
90 H.P. General Electric 900 RPM
65 H.P. G.E., 550 RPM.
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40 H.P. Cr. Wheeler, 1150 RPM
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25 H.P. West. 600 RPM
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1—200 KW **Westg. Syn. Motor Generator Set,** 600 V. D.C., Gen., connected to 290 H.P. Synch. motor 3/60/2200 and 900 RPM, with exciters and controls

1—1000 KW **Turbine type Generator,** 3/60/2300 3600 RPM, Type ATB 2

5—50 H.P. **G.E. Unused** Slip Ring Type MTC **Hoist and Crane Motors,** 600 RPM, 3/60/440.

5—50 H.P. NEW **Allen-Bradley Reversing Type Controllers,** self-contained, 3/60/440 V.

4—50 H.P. & 100 H.P. **Electric Solenoid Brakes,** 3/60/440.

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3 phase, 60 cycle, A.C.
250 KW G.E. Rotary 275 Volt D.C. 2300 Volt A.C.
150 KW West. 275 volt DC, 2300 volt A.C.
150 KW Ridgway 275 volt D.C. 2300 volt A.C.
100 KW Ridgway 275 volt D.C. 2300 volt A.C.
100 KW West. Rotary 275 Volt D.C. 2300 Volt A.C.
50 KW Allis-Chalmers 250 V. D.C. 2200 V. A.C.

SYNCHRONOUS MOTORS
3 phase, 60 cycle
2—G.E. 700 HP 720 RPM 6600/4000/2300 Volt
Burke 300 HP 900 RPM 440/220 Volt
Ridgway 150 HP 1200 RPM 2300/440 Volt
C.W. 100 HP 900 RPM 440/220 Volt
Fairbanks-Morse 75 HP 720 RPM 220 Volt
G.E. 60 HP 720 RPM 440/220 Volt

SLIP RING MOTORS 3 phase 60 cycle
G.E 60 HP 720 RPM 440/220 Volt
Allis-Chalm. 250 HP 600 RPM 440/220 Volt

ADJUSTABLE SPEED
220 Volt D.C. Motors
1—G.E. RF-18 90/120 HP 400/1200 RPM
1—G.E. RF-17 50/100 HP 450/1200 RPM
1—Reliance 1400-T 100/125 HP 300/900 RPM
1—West. SK-180, 100 HP 600/950 RPM
1—West. SK-180 45/90 HP 475/950 RPM
1—Diehl 60 HP 500/1500 RPM
1—Reliance 1400-T 50 HP 175/700 RPM
2—Crocker-Wheeler 125-H 50 HP 175/700 RPM
1—Allis-Chalm. 35/70 HP 450/1350 RPM
1—Allis-Chalm. 25 HP 600/1800 RPM

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Boilers & Generator Units to Suit Requirements

SPECIALS:
1—5000, 1—2500 & 1—2000 KW Turbo-Generators.
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2—500 hp. & 6—600 hp. Boilers, 200 lbs.

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1—625 KVA Wemco 10-C Parsons or NC 60/3/440/2200/3600—Jet Condenser—Surface available.
1—300 KW Wemco Single Wheel Re-entry 60-/3/240-120/250#.

TURBOS 25 cy

7500 KW GE Curtis Condensing Turbo 25/3/2300/1500 RPM, 175/200#. Surface Condenser.
6250 KW 80% PF Parsons design Multiple Expansion Parallel Flow 25/3/4000/1500 RPM, Surface Condenser equipped.
6000 KW GE Curtis 25/3/6600/1500 RPM, Jet Condenser equipped.
2—7200 KVA Wemco Impulse and Reaction Semi-Double Flow 25/3/11000/1500 RPM. Surface Condenser equipped.
3—4000 KW 80% old rated (log service record 7500 KW) Wemco Impulse and Reaction design 25/3/13200/1500 RPM. Surface Condenser equipped.
2—3500 KW Wemco 25/3/13200/1500 RPM with combined 18000 sq. ft. Surface Condenser.
2500 KW GE Curtis Mixed Pressure Condensing Turbo 25/3/2300/1500 RPM, 16# and 165/200#. Surface Condenser.
2—2000 KW Wemco 25/2/6600/1500 RPM Jet Condenser.

TURBOS DC

1—500 KW GE Mixed Pressure 16 to 140# 250 volts DC. Surface Condenser 3100 sq. ft.

FREQUENCY CHANGERS

5000 KW/7000 KVA Wemco Freque 62½/3/4150/375 RPM: 25/3/13200. Complete with all auxiliaries.

MOTOR GENERATORS

1—1500 KW GE MPC 60/3/4000 to: 600 volts DC.

BOILERS

3—600 HP B&W Vertical Steel Header Longitudinal 3-drum 200# Superheater and Taylor Stokers.
3—500 HP Edgemoor Steel Header Boilers—200#—Foster Superheaters.
3—500 HP B&W Stirling Boilers 200 lb. superheater equipped.
8—500 HP Edgemoor Box Steel Header Water Tube, Superheaters and Chain Grate Stoker.
4—500 HP B&W Sterling 4 Drum, Cross Drum Bent Tube Boilers 160#, Diamond Soot Blowers, Green Chain Grate Stokers.
450, 400, and 300 HP B&W Sterling 4 Drum Water Tube Boilers 160#, Green Chain Grate Stokers, Coal and Ash Handling System—Overhead.
1—418 HP B&W Stirling Boiler 200 lb.
1—484 HP Springfield Horiz. ASME Straight Tube Longitudinal Cross Drum Boilers, 200#.

REBUILT POWER EQUIPMENT—Ready to Ship

ROTARY CONVERTERS

150 kw., West. 250 v. rpm., 2200 3 ph. 60 cy.
1—200 kw. G.E. 275 v. 900 rpm., 6 ph. 60 cy. complete with overspeed device and transformers.
1—500 kw. G.E. type HC-8 600 volt, 900 rpm., 6 ph., 60 cy. pedestal bearing with overspeed device complete with transformers.

STEEL BUILDING

80' wide x 254' long, 20320 sq. ft. floor space with 40' span crane runway full length of building.

CRANE

5 ton P.&H. OET 50' span with cab, 3 Motor—230 volt D.C. complete with controllers and wiring.

MOTOR GENERATOR SETS

500 kw. Westinghouse 600 V. 514 rpm., ped. type dir. con. 770 HP., 2200 v. 3 ph. 60 cy. Syn. Motor complete
350 kw. Westinghouse 250/300 V. D.C. 514 rpm., pedestal type dir. con. Westinghouse Syn. Motor 2200/3/60 complete
200 kw. Westinghouse 600 v. D.C. 600 rpm., dir. con. 2200/3/60 Syn. Motor. Complete.
150 kw. Westinghouse 275 v. 600 rpm., dir. con. 290 HP., 2200 v. 3 ph. 60 cy. Syn. Motor.
125 kw Crocker Wheeler 250 V. D.C. 1200 rpm., 220/440 v., 3 ph. 60 cy. induction
75 kw. Westinghouse 500 V. 1200 rpm., dir. con. 220/440 v. 3 ph. 60 cy. Syn. Motor complete. Practically new
50 kw., Westinghouse 250 v. type SK, 1200 rpm., dir. con. 118 HP., 220/440 v. 3 ph. 60 cy. Syn. Motor 70% P.F. complete
50 kw. Allis Chalmers 250 V. D.C. 1200 rpm., 220/440 v. 3 ph. 60 cy. synchronous.

ENGINE GENERATOR SETS

50 kw. 250 V. D.C. International P.D.-80 DIESEL ENGINE.
175 kw. West. 2200/2/60 dir. con. Skinner Steam
200 kw. 480 v. 3 ph. 60 cy. direct connected, 300 H.P. Buckeye 4 cylinder vertical Diesel Engine.
225 kw. G.E. 220/440 or 2200 v. 3 ph. 60 cy. dir. con. Ideal Steam
225 kw. Elec. Machy. 2200 or 220 v. 2 ph. 60 cy. dir. con. Ideal Steam

100 HP. LIDGERWOOD HOIST

Double drum Speedwell 2500 lb. pull at 450' per min. direct driven by 100 hp. A.C. or D.C. Motor.

A.C. GENERATORS

219 kva. G.E. 2300/3/60 200 rpm, 80% P.F. (Can be reconnected 440 or 220 v.)

GAS ENGINE GENERATOR SET

75 kw. West. 250 v. belted to 110 HP 2 cyl. Bessemer Gas Engine.

SPECIALS IN SLIPRING MOTORS
3ph. 60 cy.

HP	Make	Speed	Type
1500	Allis Chal.	485	ANY
700	G.E.	393	MT-432
400	West.	1170	CW
260	Burke	600	EM-65
250	G.E.	590	I-174
200	West.	690	CW-956A
100	West.	1750	CI

SYNCHRONOUS MOTORS

225 HP. G.E. 2200 v. 3 ph. 60 cy. 80% P.F. 200 rpm (Can reconnect 440 or 220 v.)

TURBINE

1—Kerr Economy Steam Turbine 450 B.H.P. 3800 rpm. 5" intake, 12" exhaust with Kerr Reduction Unit 3800 to 720 rpm. 115 lbs. pres.

A.C. MOTORS—3 ph. 60 cy.

HP	Volts	Make	Type	Speed
200	2200	G.E.	IK-15	1200
200	220/440	West.	CS	1200
200	220/440	West.	CS	720
200	220/440	West.	CS	600
300	2300	West.	CS	1200
300	2200/440/220	West.	CS	450
350	2200/440/220	West.	CS	450
400	2200/440/220	West.	CS	500
450	2200/440/220	West.	CS	600
500	2200/440/220	West.	CS	720
600	2200/440/220	West.	CS	900

SPEED REDUCERS

23—3 to 10 HP Thomas, Ratio 100 to 1; 15 to 1; 10 to 1; 5 to 1.
5—10 HP. 600 At Cleveland ratio 90:1.
1—150 HP. R.D. Nuttal ratio 1.6:1.

TRANSFORMERS

Qua.	Kva.	Primary VOLTS	Secondary VOLTS	Phase
3	1	2200/2080	110/220-120/240	1
5	2	2200/2080	110/220-120/240	1
9	3	2200/2080	110/220-120/240	1
100	5	2200/2080	110/220-120/240	1
6	5	2200/2080	110/220-120/240	1
1	5	2200/2080	110/220-120/240	3
141	7½	2200/2080	110/220-120/240	1
71	10	2200/2080	110/220-120/240	1
10	15	2200/2080	110/220-120/240	1
25	25	2200/2080	110/220-120/240	1
1	30	2200/2080	110/220-120/240	1
1	37	4400	185	1 — Rotary
2	50	2200/2080	110/220-120/240	3
6	50	2200/2080	110/220-120/240	1
2	100	2200/2080	110/220-120/240	1
1	100	440	220	3
3	100	6600/550	440/220	1
3	110	2100	185	1 — Rotary
1	150	2200/2080	110/220-120/240	3

DUQUESNE ELECTRIC & MFG. CO., Pittsburgh, Pa.

SEARCHLIGHT SECTION

SLIP RING MOTORS, 3 PH., 60-CY.

HP	Volts	Make	Speed
500	2300	Whse.	450
350	220–440	G.E.	1800
350	2200	G.E.	600
300	2300–4000	G.E.	1200
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2300–440	G.E.	600
150	440–220	G.E.	1800
150	2200	G.E.	900
150	2200–440	Whse.	1800
150	550–2200	G.E.	1800
100	550–2200	G.E.	720
100	220–440	G.E.	720
100	220–440	G.E.	900
80	220–440	G.E.-MTC	900
75	440–220	G.E.	900
75	220–440	G.E.	600

SYNCHRONOUS MOTORS, 3-PH., 60-CY.

400	440–220	Whse.	.276
350	440–220	G.E.	200
240	2300–440–220	G.E.	600
200	2300–4000	G.E.	1200
150	2200	G.E.	1800
100	440–220	G.E.	1200
50	220–440	G.E.	1200

TRANSFORMERS—60 CYCLE

3—400 kva., G.E. type H, 13200-440.
3—250 kva., Al. Chal. 4150-480.
3—250 kva., G.E. type H-KD 23000-2300.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—200 kva., G.E., type H-KD, 13800-230/460.
2—150 kva., Whse. 4800/4156/2400-480/240.
3—100 kva., G.E., type H 2400-240/480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Pittsburgh, 13800-240/120.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse type SK, 13800-240/120.
3—37½ kva., G.E., type H-K 2200-460.
3—37½ kva., G.E., type H-K, 2300-230/115.
3— 25 kva., G.E., type H-K 2300-230/460.
3— 25 kva., Whse type S 2300-575.
3— 25 kva., G.E., type H-KR, 6900-230/460.

A. C. GENERATORS

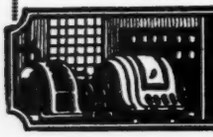
1—500 KVA, 900 r.p.m. 2209 V. Whse. Condenser.
1—312 kva., 900 r.p.m., 2300-V., Westghse.
1—300 kva., 600 r.p.m., 240-480-V., G.E.
1—225 kva., 600 r.p.m., 2200-240-480-V., G.E.
1—187 kva., 900 r.p.m., 2200-550-V., Westghse.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
500	440/220	G.E.	IK	900
400	2200	Whse.	C.S.	1800
250	2200	G.E.	IE-K	1800
250	2200	G.E.	I-K	900
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
50	220/440	G.E.	K	1800

MOTOR GENERATOR SETS

1—100 K.W., 250 V., 1200 R.P.M. Ridgeway, con. to 150 H.P., 2200 V., 3 ph., 60 cy., syn. motor.
1—60 K.W., 125 V., 1200 R.P.M. GE, type RC to 90 H.P., 4150/2300 V., 3 ph., 60 cy. syn.
1—25 K.W., 125 V., 1800 R.P.M., G.E., con. to KT 40 H.P., 2200/440 V., 3 ph., 60 cy. motor
1—GE, 3 unit set, consisting of 1 type RC, 10 KW, 250 V., 1750 RPM, and 1 RC, 10 KW, 125 V. Generators, coupled to KT, 35 H.P., 220/440 V., 3 ph., 60 cy., SC motor.



STEPHEN HALL & COMPANY, INC.
458 Seventh St., Hoboken, N. J.

BOILERS

ASME, NB and API Locomotive Firebox Boilers from 200 to 350 pounds working pressure

One 75 H.P. Boiler
One 85 H.P. Boiler
Four 90 H.P. Boilers
Four 110 H.P. Boilers
Four 125 H.P. Boilers

JOE SULLIVAN CO.
The Home of New and Used
—NOT Abused Boilers
523 N. Hamlin Ave. CHICAGO, ILL.
Phone—Van Buren 8669

NOW LOCATED AT OUR NEW PLANT

1436-1438 W. RANDOLPH
CHICAGO, ILL. MON: 7409
COMPLETE STOCK
ELECTRIC MOTORS
GENERATORS M-G-SETS
Rebuilt & Fully Guaranteed
ARTHUR WAGNER COMPANY
Electrical Engineers since 1906

FOR SALE

3—500 HP 80 RPM A.C. motors with starting equipment.
2—15-ton Hand operated Traveling Cranes. 100 foot runways.
3—Westinghouse 667 KVA Transformers. 13,800—440 v.
7—250 H.P. Dillon self-contained Vertical boilers, Massachusetts Standard Rated at 200#.

Low Prices—Immediate Removal

CONSOLIDATED PRODUCTS CO. INC.
14-17 Park Row New York, N. Y.

SLIP RING MOTORS

Three Phase, Sixty Cycle, 220/440 Volts

1— 5 H.P.	MT 181	1200 RPM	
1— 7½ H.P.		1800 RPM	
1— 7½ H.P.	IM	900 RPM	
1— 7½ H.P.	HI—M	900 RPM	
1—10 H.P.	F	900 RPM	
1— 7½ H.P.	CI	680 RPM	Crane
1— 7½ H.P.	CI	1200 RPM	Crane
1— 7½ H.P.	CW	690 RPM	
3—10 H.P.	MT	900 RPM	
1—10 H.P.	MT	1200 RPM	
3—10 H.P.	I—M	1200 RPM	
1—10 H.P.	I—M	900 RPM	
1— 7½ H.P.	CW	900 RPM	
1—10 H.P.	Wagner	1200 RPM	
1—10 H.P.	CW	1200 RPM	
1—15 H.P.	MW	800 RPM	
2—15 H.P.	CW	900 RPM	
4—15 H.P.	CW	690 RPM	
1—20 H.P.	MT	900 RPM	
1—20 H.P.	CW	600 RPM	
1—20 H.P.	Wagner	600 RPM	
1—25 H.P.	CW	1200 RPM	
1—25 H.P.	HF	1200 RPM	
4—25 H.P.	CW	900 RPM	
4—25 H.P.	CW	690 RPM	
2—25 H.P.	CW	600 RPM	
3—25 H.P.	I—M	600 RPM	
2—25 H.P.	MT	1200 RPM	
1—30 H.P.	I—M	1200 RPM	
1—30 H.P.	Wagner	540 RPM	Crane
4—30 H.P.	CW	900 RPM	
1—30 H.P.	CW	1200 RPM	
3—30 H.P.	Allis	900 RPM	
2—30 H.P.	MT	900 RPM	
2—30 H.P.	MT	1200 RPM	
1—20 H.P.	MTC	1200 RPM	
2—25 H.P.	I—M	680 RPM	
1—30 H.P.	Imperial	900 RPM	
3—40 H.P.	CI	690 RPM	New Crane
2—40 H.P.	MTC	900 RPM	Crane
1—40 H.P.	Star	900 RPM	Ball bear.
3—40 H.P.	CW	900 RPM	
1—40 H.P.	MT	1200 RPM	
3—35 H.P.	I—M	900 RPM	
3—40 H.P.	MT	900 RPM	
2—35 H.P.	CI	690 RPM	Crane
1—50 H.P.	CW	1200 RPM	
1—50 H.P.	Allis	1200 RPM	
1—40 H.P.	Allis	435 RPM	
3—50 H.P.	CW	900 RPM	
2—50 H.P.	MT	900 RPM	
4—50 H.P.	CW	680 RPM	
4—50 H.P.	MT	600 RPM	
1—50 H.P	MT	680 RPM	
3—75 H.P.	CW	600 RPM	
2—75 H.P.	CW	900 RPM	
2—75 H.P.	I—M	1200 RPM	
2—75 H.P.	I—M	900 RPM	
3—75 H.P.	MT	900 RPM	
4—75 H.P.	MT	600 RPM	
2—75 H.P.	ITC	900 RPM	Crane
3—100 H.P.	I—M	600 RPM	
1—100 H.P.	HF	1200 RPM	
1—150 H.P.	HF	600 RPM	
1—150 H.P.	ITC	680 RPM	Crane
1—125 H.P.	I—M	680 RPM	
3—100 H.P.	CW	600 RPM	
1—100 H.P.	CW	900 RPM	
1—100 H.P.	MT	900 RPM	
1—100 H.P.	MTC	900 RPM	Crane
2—200 H.P.	CI	600 RPM	Crane
2—150 H.P.	CW	600 RPM	
2—125 H.P.	CW	600 RPM	
1—300 H.P.	I—M	900 RPM	
1—300 H.P.	MT	900	
1—400 H.P.	CW	1200	
1—200 H.P.	I—M	600	

Hand control can be furnished for nearly all above and automatic for a large number

PENN ELECTRICAL ENGINEERING CO.
SCRANTON, PA.

CRANES

Electric Overhead traveling cranes

20-ton a.c. current 50 ft span.
20 ton motors missing 50 ft span.
20 ton Bedford 50 ft span electric.
8 ton P.H. ac current 220 volts.

All immediate delivery.

H.A. WOODWORTH ENG'R'G. CO. 705 OLIVE ST. ST. LOUIS, MO.

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

230 Volt—Constant Speed

	HP	Make	Type	Speed
1—	300	Cr. Wh.	CCM-108H	550
1—	250	Al. Ch.		525
2—	200	Whse.	SK	400
1—	200	G.E.	DMC	475
1—	150	G.E.	MPC	275
1—	140	G.E.	MDS-108	410
1—	125	G.E.	CDP-123	1750
3—	100	G.E.	LC-50	1200
1—	100	G.E.	RC-38	600

230 Volt—Adjustable Speed

1—	600	Whse.		150/275
1—	300	G.E.	MPC	250/400
1—	300	G.E.	MPC	275/550
2—	275	G.E.	DMC	500/750
1—	200	Whse.		460/500
1—	150	G.E.	MPC	250/450
1—	100	Al.Ch.		950/1150
1—	75	Whse.	SK	475/900
1—	75	G.E.	CD-145	575/865
1—	75	Cr.Wh.	65H	600/1200
1—	75	G.E.	C	500/1000
2—	60	El.Dy.	S	525/1050
2—	50	Cr.Wh.	CMC-81H	300/900
1—	45	G.E.	CD-125	450/1350
24—	30	Whse.	SA	500/1500
1—	25	Cr.Wh.	50H	335/1000

TRANSFORMERS

	KVA	Make	PH	Type	Voltages
1—	1500	Whse.	3	OISC	26400/13200x460
3—	1000	G.E.	1	HKDD	13800x2300
3—	333	Pitts.	1	OISC	13800x440/220
3—	300	G.E.	1	H	13200x2300/575
2—	200	Whse.	1	SK	6900x230/460
3—	200	G.E.	1	H	26400x115/460
3—	100	Whse.	1	OISC	13200x250

ENGINE GENERATOR SET

1—100 KW, Whse. D.C. Gen. 125/250 v. 3 wire 250 R.P.M. dir. Conn. 150 H.P., 14x15 Skinner steam engine 150# press

SYN. MOTOR GENERATOR SETS

3 phase—60 cycles

1—1500 KW Whse. 250 V. Gen. d.c. to 2100 HP 2200/4400 V. syn. motor.
1—1500 KW G.E. 600 v. Gen. d.c. to 2100 HP 6600 v.
1—1000 KW GE 600 v. DC to 1400 HP—2300/4000 v. motor with exciter.
1—500 KW G.E. 600 v. Gen. d.c. to 700 HP 13200 v.
2—150 KW, G.E., 550 V., Gen. d.c. to 225 H.P., 2200 V. syn. motor.

TURBO GENERATOR SET

1—500 KW, Whse., 625 KVA, 480 v., 3 ph., 60 cy. generator with Curtis single stage 160/125 pound non-condensing turbine good for 5 to 10 pounds back pressure
1—500 KW, G.E., 625 KVA, 2300 v., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 Cycle

2—1500 KW, Whse. 720 RPM 650 v. DC with 3-single phase, 33000 v. transformers and panel.
2—1000 KW whse. 900 RPM 650 v. DC with 3- single phase 11800 v. transformers and panels.
1—750 KW Whse 720 RPM 250 v. DC with three phase 6600/2300 v. transformer and panels.
1—500 KW, Westinghouse, 900 RPM, 125/250 volt, DC, with 3- single phase, 60 cycle, 13200/6600/2300 volt transformers and panels
1—300 KW, G.E., type HCC, 1200 RPM., D.C., 600 V. AC. 6 ph., 1200 RPM

ROTARY CONVERTERS

25 Cycle

3—1500 KW GE 225/275 v. DC Booster type each with 1600 KVA, 3 ph. 6765 volt transformers and panels.
1—500 KW GE 225/275 DC Booster type with 500 Kva 3 ph. 6765 volt transformer and panels.

A C MOTORS

3 phase—60 cycle
Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	350	Cr.Wh.	301	2200	600
1—	300	G.E.	ATI	440	600
1—	300	G.E.	ATI	2300	600
1—	250	G.E.	ATI	220	450
1—	200	Whse.		440	514
3—	150	G.E.	TRB	220x440	450
1—	150	Whse.		2200/550	1800
1—	100	Whse.		2200/550	1800
1—	100	Whse.	HP	220	300
1—	100	Whse.	G	2300	900

Slip Ring

1—	1000	G.E.	IM	2200	720
1—	600	G.E.	IM	2200	900
1—	600	Al.Ch.	ANY	2200	1180
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al.Ch.		2300	505
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	Whse.	CW	440	585
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514
1—	200	G.E.	IM	440	435
2—	175	G.E.	IE-15A	2200	880
1—	150	G.E.	IM	2200	695

Squirrel Cage

1—	500	G.E.	I-17B	2200	690
1—	400	G.E.	KT	2300	585
1—	300	Whse.	CS	550	580
2—	300	G.E.	IK	2300	600
1—	300	Al.Ch.		2200	1160
1—	250	Al.Ch.		220/440	1150
1—	200	Whse.	CS	440	580
1—	200	Whse.	CS	550	720
1—	200	Al.Ch.		2200	1750
1—	150	G.E.	IK	2200/440	900
3—	150	Al.Ch.	AN	220/440	1750

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

SPECIAL OFFERING
POWER PLANT, USED ONLY TWO YEARS!

TURBO GENERATORS

2—Allis Chalmers—Kerr Turbo Generators, 500 KW, 3 phase, 60 cycle, 480 volt, equipped with Westinghouse-Blanc jet condensers. Turbine can be operated non-condensing at back pressure of 10–15 lbs. Complete with switchboard and exciter.

PUMPS

1—Hill 6" double suction Centrifugal Pump, 720 GPM, 110' head.
1—Swasey 6" Centrifugal Pump
1—Swasey 8" Centrifugal Pump
1—Alberger Vacuum Pump, steam driven, 8" x 16" x 12".

WATER FILTRATION PLANT

1—N. Y. Continental Jewell Water Filtration Plant, capacity 500 gal. per minute at 60 lb. working pressure.

ELECTRIC HOISTS

2—1000 lb. DC Shephard Electric Hoists, 14' lift.
1—Howe 100 ton Railroad Track Scale.

COMPRESSOR

1300 CFM Laidlaw Dunn Gordon two stage, steam driven Compressor, 100 lb. pressure.

GENERATORS

1—Westinghouse Electrolytic Generator, 2000 amps., 200/40 volt, 650 RPM, belt driven, 3 pedestal.
1—Allis Chalmers Electrolytic Generator, 1250 amps., 40/120 volt, 475 RPM, belt driven.
1—Allis Chalmers Electrolytic Generator, 833 amps., 40/120 volt, 650 RPM, belt driven.

BOILERS

2—Heine Type, 357 HP, 2 drum O'Brien Boilers, with Laclede Christie chain grate automatic stokers, with automatic coal weighing devices, individual draft equipment, feed water heater built for 175 lb. pressure. Extra fire brick available, also extra new tubes.

PRESSURE BLOWERS

2—Connersville and Root Type SH Pressure Blowers, 24' suction and discharge, 57 and 65 cf capacity.

BRILL Equipment Corp.

183 VARICK STREET, NEW YORK CITY

PROMPT SHIPMENT FROM OUR WAREHOUSE

M-G SETS 3 ph. 60 cy. (Syn.)

150 (2) KW Ridg. 275 v. DC—2200 v. AC 900 RPM
150 KW West. 550 v. DC—2200 v. AC—1200 RPM
125 KW Cr. Wh. 250 v.—440v.—AC 1200 RPM
100 KW G.E. 250 v. DC—220 v. 580 RPM
100 KW West. 275 v. DC—2200 v. AC—1200 RPM
90 KW Al. Ch. 230 v. DC—2200 AC 900
50 KW Al. Ch. 230 v. DC—220/440 AC 1200 RPM

STEAM UNITS

1000 HP West. Mixed Pres. Turbine 3600 RPM 100# or 4#.
100 KW 250 v. DC. Westgh.—Skinner Engine
1—50 KW 125 v. Al. Ch.—Ball Engine.

SYN. MOTORS 3 ph. 60 cy.

HP	Make	Volts	Speed
350	A.C.	2300	600
2-300	G.E. ATI-.88 P.F.	440	1200
225	Ideal (Unity P.F.)	440	900
2-75	G.E.	2200	900
75	Westgh.	220	1800

ELECTRIC FURNACE

3 Ton with 3—333 KVA Transformers 22000 v. 3 ph., 60 cy.

SLIP RING & SQ. CG. MOTORS (3 ph. 60 cy.)

HP	Make	Speed	Wdg.	Type
700	G.E.	393	S.R.	MT432
450	G.E.	257	S.R.	MT
400	G.E.	1800	S.C.	
300 (2)	G.E.	1200	S.C.	
300	G.E.	600	S.R.	I-M
200	Cr. Wh.	440	S.R.	28
200	Al. Ch.	600	S.C.	
125	Al. Ch.	435	S.R.	
125	Burke	1200	S.C.	
100	G.E. 25 cy.	500	S.R.	MI-108
100	Burke	900	S.C.	
100	F. M.	600	S.C.	BB
75	West.	575	S.R.	CW868A
75	West.	1800	S.C.	CS
75	Lincoln	1800	S.C.	

DC VARIABLE MOTORS (230 VOLTS)

HP	Type	Make	Speed
75	SK	Westgh.	475/1425
20	SK	Westgh.	900/1800
10	SK	Westgh.	600/1200
5	SK	Westgh.	450/1800
2	SK	Westgh.	500/1800

AC GENERATOR

219 KVA G.E. TRE 2400/480/240 v. 3 ph. 60 cy. 200 RPM with exc.
200 KVA G.E. Type ATB 2200/440/230, 720 RPM, 3 brg.

AIR COMPRESSORS

2200 cu. ft. 100# Chic. Pneu. Steam #9198.
550 cu. ft. 100# Bury 2 stage
160 cu. ft. Chic. Pneu. 100#
67 cu. ft. Ing. Rand ER 1 100#

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2—2 Ton Yale & Towne A.C. 220/3/60
7—2 Ton Sprague 230 v. or 500 v. D.C. Mono-rail.
2—4 Ton Sprague 230 v. or 500 v. D.C. Mono-rail.

5—75 HP 230 v. Generator Electric Type 211 series wound with interpoles 550 RPM.

6—500 HP Type CS 2200 v. 3 ph. 60 cy. 500 RPM Westinghouse 3 brg.
5—350 HP Same as above.

OIL ENGINE DRIVEN AIR COMPRESSOR

Chicago Pneumatic simplate-valve Type NS03 straight line 16½" & 11" x 18" cap. 492 cu. ft. 100# pres. with air receiver and starting air compressor.

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150 HP **Fairbanks Morse** "Y" **Oil Engine.**
180 HP **Fairbanks Morse** "VA" **Diesel Engine.**
60 HP **Muncie** Horizontal **Oil Engine.**
75 KVA 3/60/2300 V. 257 rpm **Rotor & Stator.**
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200 KW Al-Ch, 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW R.W. 250 D.C. 2300/4000 A.C. 1200 RPM

SYNCH. MOTOR GENERATORS

200 KW G.E. 250 V. 2300/4000 A.C. 1200 RPM
200 KW G.E. 250 V. 2300 A.C. 720 RPM
150 KW R.W. 250 V. 2300 A.C. 900 RPM
100 KW WEST. 250 V. 2300 A.C. 900 RPM

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Above Motors complete with D.C. Exciters, Bases, Pulleys, Compensators and Automatic Starting Panels.

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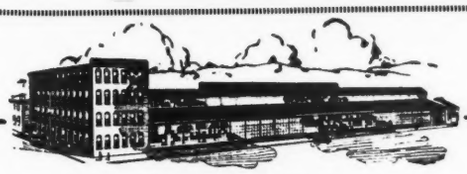

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2200 V., 3 Ph., 60 Cy.

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1—150 HP, 360 RPM, General Electric, type I-M #4027385.
1—250 HP, 450 RPM, General Electric, type I-M #4226438
1—300 HP, 450 RPM, General Electric, type MT-410 #4027188.
1—[illegible] 600 RPM, General Electric, type I-M, #4226553.
1—350 HP, 900 RPM, Westinghouse, type CW, #4847345.
1—450 HP, 600 RPM, Westinghouse, type CW, #2655215.

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3—500 KW General Electric, 600 volts, D.C., direct connected to 700 HP, 720 RPM, 2500/5000 volts, 3 phase, 60 cycles Synchronous Motor with direct connected exciters.

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2—500 KW, 1200 RPM Westinghouse, 6 phase, 600 volts, 60 cy.

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1—125 KW, 125 volt, 250 RPM, Westinghouse Generator connected to a 15" x 16" Skinner Automatic Engine.
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2—75 HP, 2200 V, **Fairbanks Morse,** 1800 RPM, 3 PH, 60 CY slip ring motor, direct connected to 500 GPM 3 stage 300' head pump.

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1—300 HP **Allis Chalmers,** 3 PH, 25 CY, 440 V, 485 RPM slip ring.

2—250 HP **Westinghouse,** type CS1012, 3 PH, 60 CY, 440 V, 435 RPM sq. cage.

1—200 HP **Westinghouse** syn. 1 PF, 3 PH, 60 CY, 2200 V 600 RPM with direct connected exciter, 3 or 2 bearing.

2—150 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 450 RPM slip ring.

2—150 HP **Westinghouse,** type CW, frame 1000, 2 PH, 60 CY, 440 V, 450 RPM slip ring.

2—100 HP **Westinghouse,** type CS, frame 754 C, 3 PH, 60 CY, 440 V, 870 RPM sq. cage.

3—150 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 1750 RPM sq. cage.

1—100 HP **Westinghouse,** type CCL, 3 PH, 60 CY, 2200 V, 1750 RPM sq. cage.

1—100 HP **Wagner,** type 26V5BP, 3 PH, 60 CY, 440 V, 860 RPM sq. cage

2—100 HP **Allis Chalmers,** type ANY, 3 PH, 60 CY, 440 V, 690 RPM slip ring.

1—100 HP **Westinghouse,** type SK, frame 160, 230 V, 1100 RPM.

1—100 HP **Allis Chalmers,** type ANY, 3 PH, 60 CY, 2200 V, 690 RPM slip ring.

1—75 HP **Allis Chalmers,** 3 PH, 60 CY, 440 V, 450 RPM slip ring.

1—75 HP **Westinghouse,** type CW, 3 PH, 60 CY, 440 V, 720 RPM slip ring, 3 or 2 bearing.

1—75 HP **Fairbanks Morse,** type H, frame 165 C, 3 PH, 60 CY, 550 V, 900 RPM sq. cage.

2—75 HP, **General Electric,** type I, 3 PH, 60 CY, 220 V, 720 RPM sq. cage.

1—75 HP, **General Electric,** type MT, frame 337, 220 V, 3-60-1745 RPM.

1—75 HP **Lincoln,** type IQ, 2 PH, 60 CY, 440 V, 600 RPM sq. cage.

1—75 HP **Finn-Weiksel (Wagner)** ty. 26VRN, 3 PH, 60 CY, 220 V, 1200 RPM syn.

1—250 HP **Crocker Wheeler,** type CCM, size 151 H, 230 V, 600 RPM, DC

3—100 HP **General Electric,** type CD, frame 123, 230 V, 1200 RPM DC

1—60 HP **General Electric,** type CD, frame 115, 230 V, 850 RPM, DC

1—50 HP **Westinghouse,** type SK, frame 160, 230 V, DC, 565 RPM

1—50 HP **General Electric,** Class 6, Form B, 600 V, DC, 600 RPM

1—50 HP **Ideal,** type SMS, 3 PH, 60 CY, 220 V, 1800 RPM, synchronous.

1—60 HP **Westinghouse,** type SK, frame 160, 230 V, DC, 680 RPM

1—60 HP **C&C,** 230 V, DC, 250/1000 RPM

1—75 HP **General Electric,** type CD, frame 176, 550 V, DC, 250/1000 RPM

3—75 HP **Westinghouse,** type SK, frame 150, 230 V, DC, 1100 RPM

1—100 KW **General Electric,** type DLC, 125 V, DC, 440 V, AC M-G set.

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1—380 HP **Heine boilers**, 180# pressure.
3—512 HP **Stirling**, Class S-26 200# pressure.
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1—15 Ton 50 ft. span three motor **AC Crane**, overhauled.
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1—2500 KVA **Nordberg uniflow engine generator set.**
5—180 HP **Fairbanks-Morse** Model 35, Oil Engines, new in 1935.
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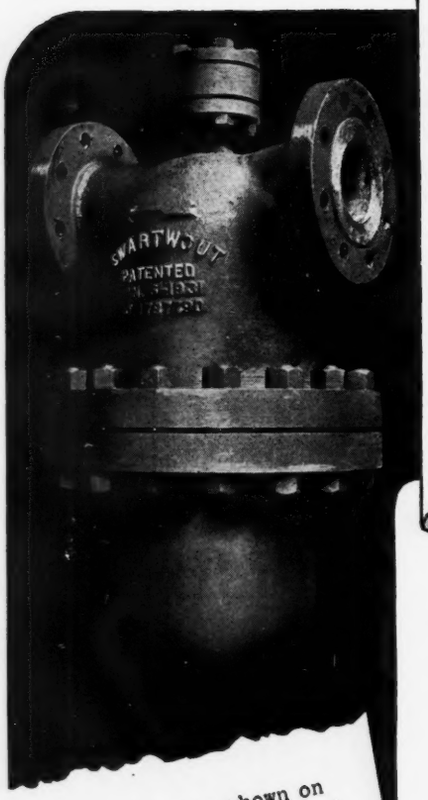
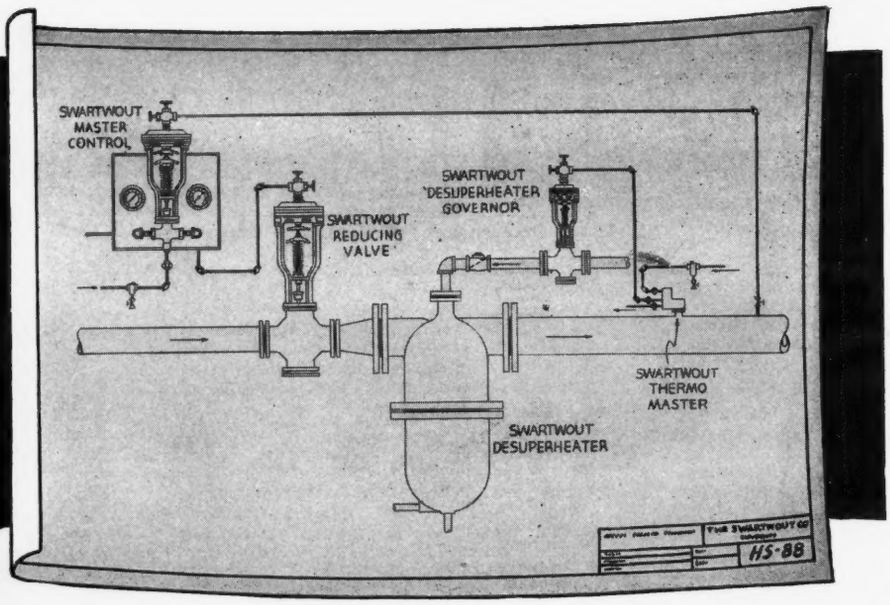
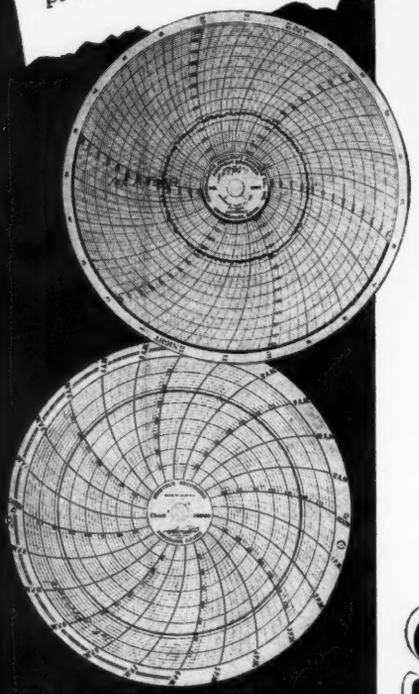




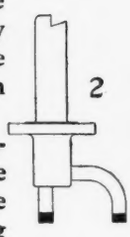
"The regulation shown on these charts has exceeded our expectations in controlling the temperature of our desuperheated steam * * * the close regulation of our (Swartwout) high-pressure reducing valve."



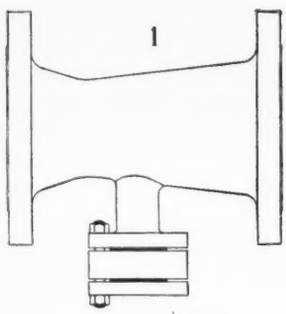
Charts—on widely fluctuating load—show performance referred to above.

You can bank on safe, rigidly controlled steam temperatures with Swartwout Desuperheaters

YOU'LL FIND it means much to your sense of security, where moderate steam temperatures are required — and especially now, with the need of pressing older equipment into service — to have the dependable guaranteed control you get with Swartwout Desuperheaters.



Better still — to have a Reducing and Desuperheating Station completely designed by Swartwout to handle your entire job of temperature and pressure reduction, brings you the advantage of properly related equipment smoothly working together. When Swartwout assumes this *unit responsibility* your reducing and desuperheating worries vanish. You get safety features which guard your plant against accidents and delays.



Desuperheaters of the Carburetor, Venturi (1), and Atomizer (2) types have been developed to a high point of efficiency by Swartwout in more than 35 years experience with power plant equipment. Hundreds of users — *like this chief operating engineer of an eastern leather producer* (excerpts from letter, left) — bank on their Swartwout Equipment to give safe, uniform control. Write today for Desuperheater Bulletins S-21-D and S-188-A.

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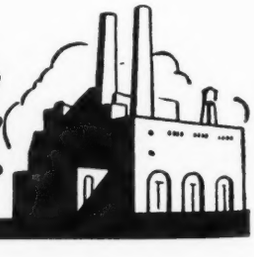

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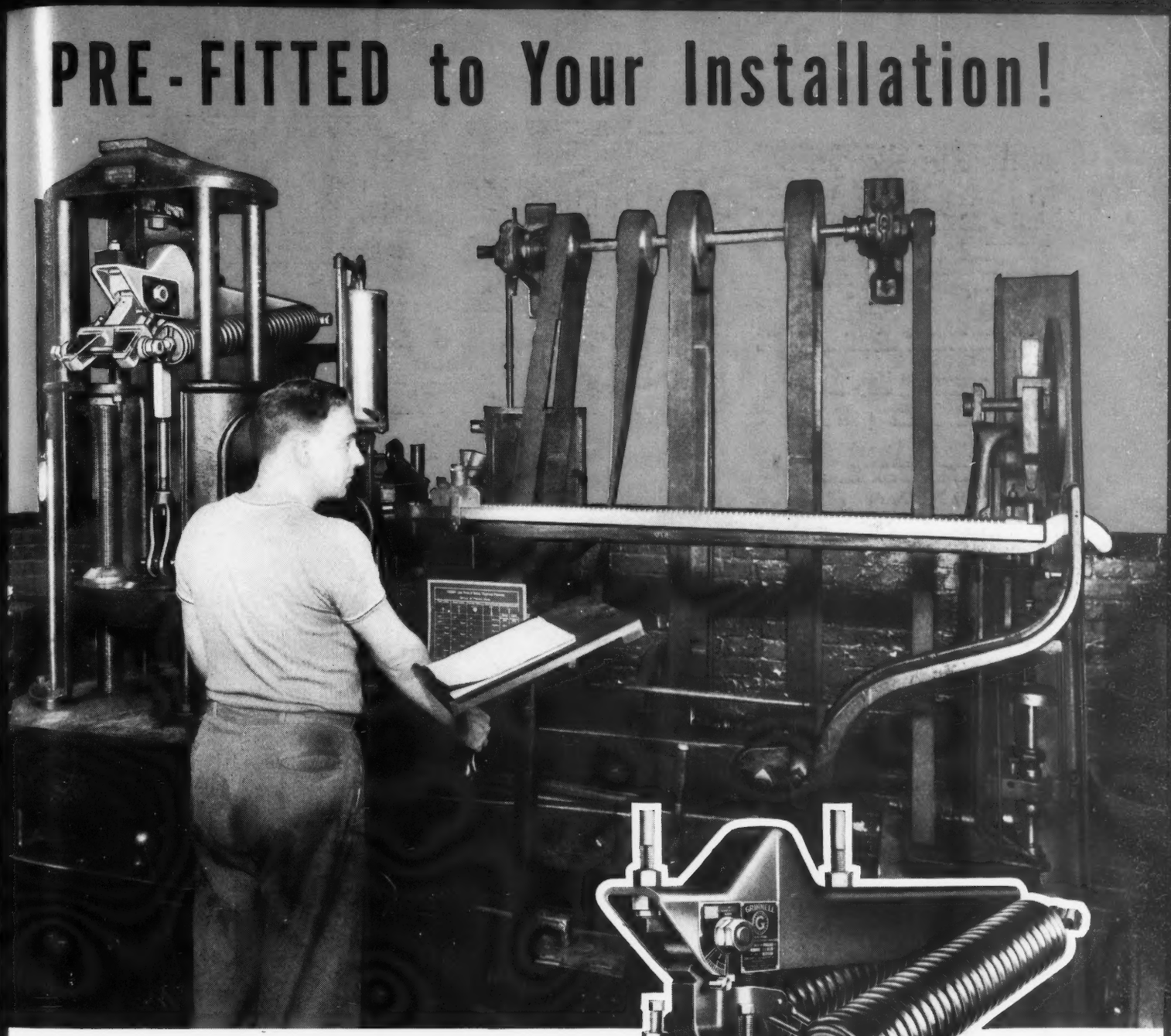

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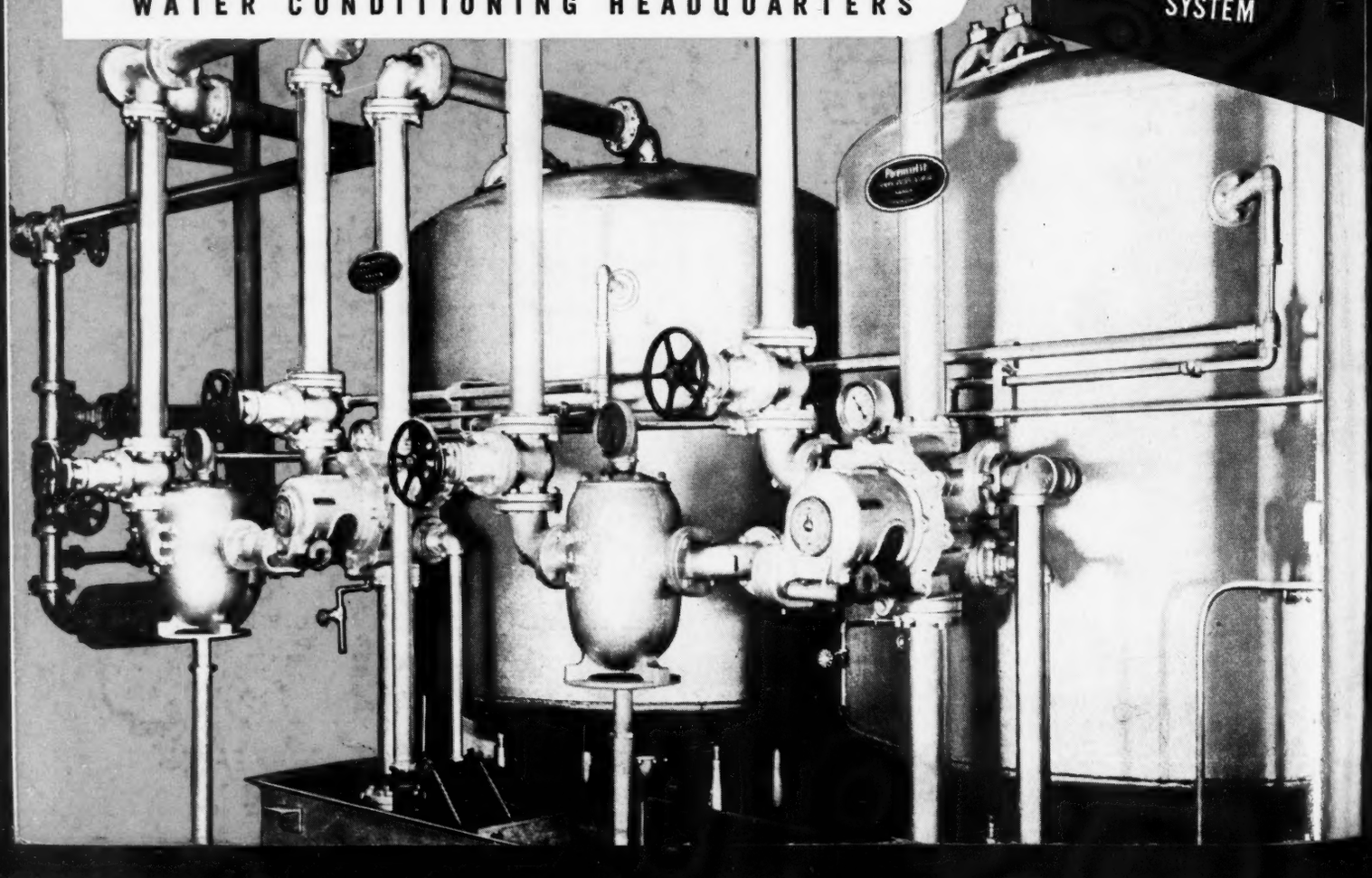
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